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ENGINEERING CHANGE NOTICE

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13a. Description of Change — 13b. Design Baseline Document? [] Yes [X] No

The document has been totally revised to include the results of recent sampling to address technical issues associated with the waste, and to update the best basis standard inventory.

14a. Justification (mark one)

Criteria Change	[X]	Design Improvement	[]	Environmental	[]	Facility Deactivation	[]
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14b. Justification Details

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15. Distribution (include name, MSIN, and no. of copies)

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19. Change Impact Review: Indicate the related documents (other than the engineering documents identified on Side 1) that will be affected by the change described in Block 13. Enter the affected document number in Block 20.

SDD/DD	[]	Seismic/Stress Analysis	[]	Tank Calibration Manual	[]
Functional Design Criteria	[]	Stress/Design Report	[]	Health Physics Procedure	[]
Operating Specification	[]	Interface Control Drawing	[]	Spares Multiple Unit Listing	[]
Criticality Specification	[]	Calibration Procedure	[]	Test Procedures/Specification	[]
Conceptual Design Report	[]	Installation Procedure	[]	Component Index	[]
Equipment Spec.	[]	Maintenance Procedure	[]	ASME Coded Item	[]
Const. Spec.	[]	Engineering Procedure	[]	Human Factor Consideration	[]
Procurement Spec.	[]	Operating Instruction	[]	Computer Software	[]
Vendor Information	[]	Operating Procedure	[]	Electric Circuit Schedule	[]
OM Manual	[]	Operational Safety Requirement	[]	ICRS Procedure	[]
FSAR/SAR	[]	IEFD Drawing	[]	Process Control Manual/Plan	[]
Safety Equipment List	[]	Cell Arrangement Drawing	[]	Process Flow Chart	[]
Radiation Work Permit	[]	Essential Material Specification	[]	Purchase Requisition	[]
Environmental Impact Statement	[]	Fac. Proc. Samp. Schedule	[]	Tickler File	[]
Environmental Report	[]	Inspection Plan	[]		[]
Environmental Permit	[]	Inventory Adjustment Request	[]		[]

20. Other Affected Documents: (NOTE: Documents listed below will not be revised by this ECN.) Signatures below indicate that the signing organization has been notified of other affected documents listed below.

Document Number/Revision	Document Number/Revision	Document Number Revision
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21. Approvals

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Design Authority			Design Agent		
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Tank Characterization Report for Double-Shell Tank 241-AW-104

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U.S. Department of Energy Contract DE-AC06-87RL10930

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Abstract: This document summarizes the information on the historical uses, present status, and the sampling and analysis results of waste stored in Tank 241-AW-104. This report supports the requirements of the Tri-Party Agreement Milestone M-44-15B.

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Revision 1

Tank Characterization Report for Double-Shell Tank 241-AW-104

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LIST OF TERMS

ANOVA	analysis of variance
Btu/hr	British thermal units per hour
Ci	curie
Ci/L	curies per liter
CI	confidence interval
cm	centimeter
cm^3	cubic centimeter
coul.	coulometry
df	degrees of freedom
DQO	data quality objective
DSC	differential scanning calorimetry
DSSF	double-shell slurry feed
DW	dry weight
ft	feet
g	gram
g/L	grams per liter
g/mL	grams per milliliter
GEA	gamma energy analysis
HDW	Hanford defined waste
IC	ion chromatography
ICP	inductively coupled plasma spectrometry
in.	inch
J/g	joules per gram
kg	kilogram
kgal	kilogallon
kL	kiloliter
kW	kilowatt
LL	lower limit
m	meter
M	moles per liter
mL	milliliter
mm	millimeter
n/a	not applicable
N/A	not available
n/r	not reported
PHMC	Project Hanford Management Contractor
Pot.auto	potentiometric titration
ppm	parts per million
PUREX	Plutonium-Uranium Extraction (Facility)
QC	quality control
REML	restricted maximum likelihood estimation

LIST OF TERMS (Continued)

RPD	relative percent difference
SAP	sampling and analysis plan
Sep/APC	separation/alpha proportional counting
Sep/BPC	separation/beta proportional counting
SMM	supernatant mixing model
SpG	specific gravity
TCR	tank characterization report
TGA	thermogravimetric analysis
TIC	total inorganic carbon
TLM	tank layer model
TOC	total organic carbon
TWRS	Tank Waste Remediation System
UL	upper limit
W	watt
WSTRS	Waste Status and Transaction Record Summary
wt%	weight percent
%	percent
°C	degrees Celsius
°F	degrees Fahrenheit
μCi/g	microcuries per gram
μCi/mL	microcuries per milliliter
μeq/g	microequivalents per gram
μg C/g	micrograms of carbon per gram
μg C/mL	micrograms of carbon per milliliter
μg/g	micrograms per gram
μg/mL	micrograms per milliliter

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1.0 INTRODUCTION

A major function of the Tank Waste Remediation System (TWRS) is to characterize waste in support of waste management and disposal activities at the Hanford Site. Analytical data from sampling and analysis and other available information about a tank are compiled and maintained in a tank characterization report (TCR). This report and its appendixes serve as the TCR for double-shell tank 241-AW-104.

The objectives of this report are 1) to use characterization data in response to technical issues associated with tank 241-AW-104 waste, and 2) to provide a standard characterization of this waste in terms of a best-basis inventory estimate. Section 2.0 summarizes the response to technical issues, Section 3.0 shows the best-basis inventory estimate, Section 4.0 makes recommendations about the safety status of the tank and additional sampling needs. The appendixes contain supporting data and information. This report supports the requirements of the *Hanford Federal Facility Agreement and Consent Order* (Ecology et al. 1997), Milestone M-44-15b, change request M-44-97-03 to "issue characterization deliverables consistent with the Waste Information Requirements Documents developed for 1998."

1.1 SCOPE

The characterization information in this report originated from sample analyses and known historical sources. The results of recent sample events will be used to fulfill the requirements of the data quality objectives (DQOs) and memorandums of understanding specified in Brown et al. (1997) for this tank. Other information can be used to support conclusions derived from these results.

Appendix A contains historical information for tank 241-AW-104 including surveillance information, records pertaining to waste transfers and tank operations, and expected tank contents derived from a process knowledge model. Appendix B summarizes recent sampling events (see Table 1-1), sample data obtained before 1989, and sampling results. Appendix C reports the statistical analysis and numerical manipulation of data used in issue resolution. Appendix D contains the evaluation to establish the best basis for the inventory estimate. Appendix E is a bibliography that resulted from an in-depth literature search of all known information sources applicable to tank 241-AW-104 and its respective waste types. The reports listed in Appendix E are available in the Lockheed Martin Hanford Corp. (LMHC) Tank Characterization and Safety Resource Center.

Table 1-1. Summary of Recent Sampling.

Sample/Date[1]	Phase	Location	Segmentation	% Recovery
Supernatant grab sample (9/27 to 9/28/94)	Liquid	Riser 16C	3 grab samples	N/A
Push core (6/19 to 6/23/97)	Solid/liquid	Riser 13A	8 segments, upper half and lower half	35% to 93%
Push core (6/24 to 6/25/97)	Solid/liquid	Riser 15A	8 segments, upper half and lower half	64% to 100%
Combustible gas test (6/97)	Gas	Tank headspace 6.1 m (20 ft) below top of riser	n/a	n/a

Notes:

N/A = not available
n/a = not applicable

[1]Dates are in the mm/dd/yy format.

1.2 TANK BACKGROUND

Tank 241-AW-104 entered service in 1980 by receiving dilute caustic solution waste (Agnew et al. 1997b). In 1981, the tank received waste from tank 241-AY-101. Beginning in 1982 and continuing throughout its transfer history, the tank was used to support 242-A Evaporator operation. From the third quarter of 1982 to the first quarter of 1986, dilute non-complexed waste was transferred to the tank from tank 241-AW-102 as 242-A Evaporator bottoms. Supernatant waste was transferred to the 242-A Evaporator through tank 241-AW-102 as 242-A Evaporator feed from the third quarter of 1982 to the first quarter of 1989. Dilute non-complexed waste was transferred from the tank to tank 241-AW-105 in the third quarters of 1982 and 1983. From the fourth quarter of 1982 to the first quarter of 1983, the tank received decladding waste from the Plutonium-Uranium Extraction (PUREX) Facility . In the third quarter of 1983 supernatant waste was transferred to the tank from tank 241-AZ-101. In the fourth quarter of 1982 and from the third quarter of 1986 to the second quarter of 1991, the tank received PUREX low-level waste. Throughout its transfer history, the tank has received periodic additions of flush water from miscellaneous sources.

Table 1-2 summarizes the description of tank 241-AW-104. The tank has a maximum capacity of 4,390 kL (1,160 kgal), and presently contains an estimated 4,235 kL (1,119 kgal) of dilute non-complexed waste (Hanlon 1998). The tank is not on the Watch List (Public Law 101-510).

Table 1-2. Description of Tank 241-AW-104.

TANK DESCRIPTION	
Type	Double-Shell
Constructed	1978-1980
In service	1980
Diameter	22.9 m (75.0 ft)
Operating depth	10.5 m (34.5 ft)
Capacity	4,390 kL (1,160 kgal)
Bottom shape	Flat
Ventilation	Operating exhauster
TANK STATUS	
Waste classification	Dilute noncomplexed
Total waste volume[1]	4,235 kL (1,119 kgal)
Supernatant volume	3,361 kL (888 kgal)
Saltcake volume	284 kL (75 kgal)
Sludge volume	590 kL (156 kgal)
Drainable interstitial liquid volume	114 kL (30 kgal)
Waste surface level (May 31, 1998)[2]	1,033 cm (406.86 in.)
Temperature (May 31, 1997 to May 31, 1998)	16.6 °C (61.9 °F) to 26.7 °C (80.0 °F)
Integrity	Sound
Watch List	None
Flammable Gas Facility Group	2
SAMPLING DATE	
Grab sample	September 1994
Core sample	June 1997
SERVICE STATUS	
Active service	

Notes:

[1]Waste volume is estimated from surface level measurements (Hanlon 1998)..

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2.0 RESPONSE TO TECHNICAL ISSUES

The following technical issues have been identified for tank 241-AW-104 (Brown et al. 1997).

- **Safety screening**: Does the waste pose or contribute to any recognized potential safety problems?

- **Flammable gas**: Does a possibility exist for releasing flammable gases into the headspace of the tank or releasing chemical or radioactive materials into the environment?

- **Organic solvents**: Does an organic solvent pool exist that may cause a fire or ignition of organic solvents in entrained waste solids?

- **Compatibility**: Will safety problems be created as a result of commingling waste types in interim storage? Do operations issues exist that should be addressed before waste is transferred?

- **Privatization**: Do the samples taken from tank 241-AW-104 and the subsequent laboratory analysis meet the needs of the privatization low-activity waste DQO (Wiemers and Miller 1997)?

The sampling and analysis plan (Benar 1997) specifies the types of sampling and analysis used to address these issues. Data from the analysis of the 1997 push-mode core samples and combustible gas test results provided the means to respond to the technical issues. Sections 2.1 through 2.5 present the responses. See Appendix B for sample and analysis data for tank 241-AW-104.

2.1 SAFETY SCREENING

The data needed to screen the waste in tank 241-AW-104 for potential safety problems are documented in *Tank Safety Screening Data Quality Objective* (Dukelow et al. 1995). These potential safety problems are exothermic conditions in the waste, flammable gases in the waste and/or tank headspace, and criticality conditions in the waste. These conditions are addressed individually in Sections 2.1.1 through 2.1.3.

Two core samples (cores 204 and 206) were obtained during the 1997 sampling event. The intent of the sampling event was to obtain two vertical profiles of the tank solids layer only (the bottom 366 cm [144 in.]) (Bell 1997). Eight segments were recovered for each core.

2.1.1 Exothermic Conditions (Energetics)

The first requirement outlined in the safety screening DQO (Dukelow et al. 1995) is to ensure that tank 241-AW-104 does not contain sufficient exothermic constituents (organic or ferrocyanide) to pose a safety hazard. Because of this requirement, energetics in tank 241-AW-104 waste were evaluated. The safety screening DQO required that the waste sample profile be tested for energetics every 24 cm (9.5 in.) to determine whether the energetics exceeded the safety threshold limit. The threshold limit for energetics is 480 J/g on a dry-weight basis. Results obtained using differential scanning calorimetry indicated that no sample obtained from tank 241-AW-104 had mean exothermic reactions (on a dry-weight basis) exceeding the safety screening DQO limit. The maximum dry-weight exotherm observed was 111 J/g from the drainable liquid of segment 21, core 206. The maximum upper limit to a 95 percent confidence interval on the mean was 125 J/g from the same sample.

2.1.2 Flammable Gas

Headspace measurements were taken from the tank dome space before taking the June 1997 push core samples. Flammable gas was not detected in the tank headspace (0 percent of the lower flammability limit) before sampling. Data for the combustible headspace gas test (sniff test) are presented in Appendix B.

2.1.3 Criticality

The safety screening DQO threshold for criticality, based on the total alpha activity, is 1 g/L. Because total alpha activity is measured in μCi/mL instead of g/L, the 1 g/L limit is converted into units of μCi/mL by assuming that all alpha decay originates from ^{239}Pu. The safety threshold limit is 1 g ^{239}Pu per liter of waste. Assuming that all alpha is from ^{239}Pu and using the maximum solids density of 1.69 g/mL, 1 g/L of ^{239}Pu is 36.4 μCi/g of alpha activity. The maximum total alpha activity result was 4.49 μCi/g (core 206, segment 19, lower half). The maximum upper limit to a 95 percent confidence interval on the mean was 4.86 μCi/g (core 206, segment 19, lower half), indicating that the potential for a criticality event is extremely low. Therefore, criticality is not a concern for this tank. Appendix C contains the method used to calculate confidence limits.

2.2 FLAMMABLE GAS DATA QUALITY OBJECTIVE

The applicability of the flammable gas DQO (Bauer and Jackson 1997) has been extended to all tanks. Analyses and evaluations will change to meet program needs until this issue is resolved. The unreviewed safety question for flammable gas safety issues is expected to be closed in fiscal year 1998, and final resolution of the flammable gas safety issue is expected to be completed by September 30, 2001 (Johnson 1997). These dates are consistent with

Milestone M-40-09 and M-40-00 (Ecology et al. 1997) to close out the unreviewed safety question for Watch List tanks and to resolve all flammable gas safety issues for high-priority tanks. For tank 241-AW-104, the analyses required by the flammable gas DQO are to be performed opportunistically when the tank is being sampled for other purposes. Because the June 1997 core sampling event occurred before the release of the flammable gas DQO (December 1997), flammable gas DQO analyses were not performed on the core samples. Analyses to address the flammable gas DQO will likely be performed during the next sampling and analysis event for tank 241-AW-104.

2.3 ORGANIC SOLVENTS SAFETY SCREENING

The data required to support the organic solvents safety screening issue are documented in the *Data Quality Objective to Support Resolution of the Organic Solvent Safety Issue* (Meacham et al. 1997). The DQO requires tank headspace samples to be analyzed for total nonmethane organic compounds to determine whether the organic extractant pool in the tank is a hazard. The purpose of this assessment is to ensure that an organic solvent pool fire or ignition of organic solvents cannot occur.

No vapor samples have been taken to estimate the organic pool size. However, the organic program has determined that even if an organic solvent pool does exist, the consequence of a fire or ignition of organic solvents is below risk evaluation guidelines for all the tanks (Brown et al. 1998). Consequently, vapor samples are not required for this tank. The organic solvents issue is expected to be closed for all tanks in fiscal year 1998.

2.4 COMPATIBILITY

Tank 241-AW-104 is an active waste storage tank. Before pumping waste to or from other waste tanks or from waste generators, tank farms operations performs a waste compatibility assessment. The waste compatibility assessment ensures that the waste in tank 241-AW-104 is compatible with the proposed source or double-shell tank receiver tank waste. The *Data Quality Objectives for Tank Farms Waste Compatibility Program* (Mulkey and Miller 1997 and Fowler 1995) directs the waste compatibility assessment. A waste compatibility assessment adhering to current requirements will need to be performed before transferring waste to or from tank 241-AW-104.

A waste compatibility assessment (Dodd 1994) was performed for tank 241-AW-104 in 1994 in preparation for transferring waste to tank 241-AP-107 to support the 242-A Evaporator Campaign 95-1. The assessment was performed under the guidance of *Data Quality Objectives for the Waste Compatibility Program* (Carothers 1994) and *Tank Farm Waste Compatibility Program* (Sutey 1994) and data from three 1994 grab samples were used. The assessment determined that all requirements of Carothers (1994) and Sutey (1994) were met for tank 241-AW-104; therefore, the supernatant in the tank was compatible with the waste in both tank 241-AP-107 and tank 241-AW-103, which was also sending waste to tank 241-AP-107 to support the evaporator campaign. However, the waste was not transferred to tank 241-AP-107 because of pump problems.

2.5 PRIVATIZATION

Tank 241-AW-104 was selected as one of the source tanks for low-activity waste feed for the privatization contractor, which placed it within the scope of the privatization low-activity waste DQO (Wiemers and Miller 1997). Since the release of Revision 3 of Brown et al. (1997), the privatization issue has been subdivided into numerous sub-issues, each addressed by a separate DQO. Revision 4 of Brown et al. (1998) identifies the privatization sub-issue of waste feed delivery as being applicable to the tank.

The privatization baseline is currently under review. The applicability of this issue to tank 241-AW-104 may change as privatization needs change. To date, no samples or specific analyses on waste from tank 241-AW-104 have been requested to address the privatization issue.

2.6 OTHER TECHNICAL ISSUES

2.6.1 Tank Heat Load

A factor in assessing tank safety is the heat generation and temperature of the waste. Heat is generated in the tanks from radioactive decay. An overall tank heat load estimate based on sampling data is not available, as radionuclide analyses other than total alpha activity were not required or performed for the 1997 sampling event; only the supernatant was analyzed for radionuclides during the 1994 grab sampling. An estimate based on the supernatant results only from the 1994 sampling yielded a value of 67.8 W (232 Btu/hr). This estimate was based on data for ^{241}Am, ^{137}Cs, ^{134}Cs, ^{90}Sr, and $^{239/240}$Pu. The heat load estimate based on the tank process history is 4.32 W (14.8 Btu/hr) (Agnew et al. 1997a), while an estimate based on the tank headspace temperature was 11,000 W (37,000 Btu/hr) (Kummerer 1995). All of these estimates are well below the limit of 20,500 W (70,000 Btu/hr) for AW-farm tanks (Cox 1997).

2.6.2 Additional Issues from Revision 4 of the Technical Basis

Since the sampling and analysis of tank 241-AW-104, Revision 4 of the *Tank Characterization Technical Sampling Basis* has been issued (Brown et al. 1998). Revision 4 identifies the additional issues of waste feed delivery and regulatory dangerous waste concerns. The waste feed delivery issue is discussed in Section 2.5. The regulatory dangerous waste issue is addressed by *Data Quality Objectives for Regulatory Requirements for Dangerous Waste Sampling and Analysis* (Mulkey 1996). This DQO contains sampling and analytical requirements to meet the dangerous (hazardous) waste regulations. Because of the analytes required by the DQO, further sampling and analysis are required to address this issue.

2.7 SUMMARY

The results of all analyses performed to address potential safety issues showed that primary analytes did not exceed safety decision threshold limits. Table 2-1 summarizes the technical issues and the analytical results that support resolution of those issues.

Table 2-1. Summary of Technical Issues. (2 sheets)

Issue	Sub-issue	Result
Safety screening	Energetics	Exotherms observed in 5 samples; all were well below 480 J/g. The largest dry weight exotherm was 111 J/g.
	Flammable gas	Vapor measurement by combustible gas meter reported 0 percent of lower flammability limit.
	Criticality	All analytical results were well below the total alpha threshold of 36.4 μCi/g for the solids and 61.5 μCi/mL for the drainable liquid (the 95 percent confidence limit on the mean for each sample was below the threshold as well).
Flammable gas	Mechanisms for generation, retention, and release Waste models	No sampling or analyses has been performed to address this issue. Analyses should be performed opportunistically during the next sampling event.
Organic solvents	Solvent pool size	Total non-methane hydrocarbons were not measured. The organic program has determined that even if an organic solvent pool does exist, the consequence of a fire or ignition of organic solvents is below risk evaluation guidelines for all of the tanks (Brown et al. 1998). Consequently, vapor samples are not required for this tank.

Table 2-1. Summary of Technical Issues. (2 sheets)

Issue	Sub-issue	Result
Compatibility	Waste compatibility assessment	A waste compatibility assessment adhering to current criteria will be required before transferring waste into or from tank 241-AW-104. A 1994 assessment demonstrated that the supernatant in the tank met all applicable criteria.
Privatization	Low-activity waste	No samples or specific analyses have been performed for tank 241-AW-104 to address privatization issues. Because the privatization baseline is under review, the applicability of this issue to the tank may change.

3.0 BEST-BASIS STANDARD INVENTORY ESTIMATE

Information about chemical, radiological, and/or physical properties is used to perform safety analyses, engineering evaluations, and risk assessments associated with waste management activities, as well as regulatory issues. These activities include overseeing tank farm operations and identifying, monitoring, and resolving safety issues associated with these operations and with the tank waste. Disposal activities involve designing equipment, processes, and facilities for retrieving waste and processing it into a form suitable for long-term storage or disposal.

Chemical and radiological inventory information is generally derived using one of three approaches: 1) component inventories are estimated using the results of sample analyses, 2) component inventories are estimated using the Hanford Defined Waste (HDW) model (Agnew et al. 1997a) based on process knowledge and historical information, or 3) a tank-specific process estimate is made based on process flowsheets, reactor fuel data, essential material use, and other operating data. The information derived from these different approaches is often inconsistent.

An effort is under way to provide waste inventory estimates that will serve as standard characterization source terms for the various waste management activities (Hodgson and LeClair 1996). As part of this effort, available information for tank 241-AW-104 was evaluated and a best-basis inventory was established. The following information was used as part of this evaluation:

- Analytical data from two core samples obtained in 1997 (Steen 1997) and two supernatant and one sludge grab sample obtained in September 1994 (Rollison 1995).

- Statistical analysis of the analytical data from the two 1997 core samples and core sample profiles from the 1997 sampling event.

- Analytical data from 242-A Evaporator/Crystallizer Fiscal Year 1985 Campaign Run 85-1 Post-Run Document (Pontious 1985).

- Inventory estimates generated from the HDW model (Agnew et al. 1997a).

Once the best-basis inventories were determined, the hydroxide inventory was calculated by performing a charge balance with the valences of other analytes. The charge balance approach is consistent with the approach used in Agnew et al. (1997a).

The best-basis inventory for tank 241-AW-104 is presented in Tables 3-1 and 3-2. The inventory estimates for most of the chemical components are based on sample results. For the other chemicals, inventory results are based on a combination of sample results, an engineering assessment, and/or HDW model results. Where no sampling or engineering estimate exists, the HDW model results were used. Finally, inventories for a few components are revised based on process knowledge. The inventory values reported in Tables 3-1 and 3-2 are subject to change. Refer to the Tank Characterization Database for the most current inventory values.

Best-basis tank inventory values are derived for 46 key radionuclides (as defined in Section 3.1 of Kupfer et al. 1997). Often, waste sample analyses have only reported ^{90}Sr, ^{137}Cs, $^{239/240}$Pu, and total uranium (or total beta and total alpha), while other key radionuclides such as ^{60}Co, ^{99}Tc, ^{129}I, ^{154}Eu, ^{155}Eu, and ^{241}Am have been infrequently reported. For this reason, most of the 46 key radionuclides had to be derived by computer models. These models estimate radionuclide activity in batches of reactor fuel, account for the split of radionuclides to various separations plant waste streams, and track their movement with tank waste transactions. These computer models are described in Kupfer et al. (1997), Section 6.1, and in Watrous and Wootan (1997). Model-generated values for radionuclides in any of the 177 tanks are reported in the HDW, Rev. 4, model results (Agnew et al. 1997a). The best-basis value for any one analyte may be either a model result or a sample- or engineering-assessment-based result if available. For a discussion of typical error between model-derived values and sample-derived values, see Kupfer et al. (1997), Section 6.1.10.

Table 3-1. Best-Basis Inventory Estimates for Nonradioactive Components in Tank 241-AW-104 (Effective May 31, 1998). (2 sheets)

Analyte	Total inventory (kg)	Basis (S, M, E, or C)	Comment
Al	60,100	S	
Bi	0	E	Bi is relatively insoluble in the supernatants added to this tank.
Ca	3,760	S/E	Upper-bound limit
Cl	11,300	S	
TIC as CO_3	1.77E+05	S	
Cr	2,740	S	
F	35,200	S	
Fe	6,580	S	
Hg	0	E	Simpson (1998)
K	24,600	S/M	Used TLM solids inventory and sample-based liquid inventory.
La	0	E	No evidence of 224 waste in this tank.
Mn	2,150	S	

Table 3-1. Best-Basis Inventory Estimates for Nonradioactive Components in Tank 241-AW-104 (Effective May 31, 1998). (2 sheets)

Analyte	Total inventory (kg)	Basis (S, M, E, or C)	Comment
Na	5.47E+05	S	
Ni	2,810	M	
NO_2	2.05E+05	S	
NO_3	3.30E+05	S	
OH_{TOTAL}	2.31E+05	C	
Pb	35.3	M	
PO_4	4,420	S	
Si	2,400	S	
SO_4	17,900	S	
Sr	0.0297	E	Assumed ^{90}Sr is 30 percent of total strontium.
TOC	20,900	S	
U_{TOTAL}	24,200	S/E	Upper-bound limit
Zr	1,140	S/E	

Notes:

S = sample base, M = HDW model-based (Agnew et al. 1997a), E = engineering assessment-based, and C = calculated by charge balance; includes oxides as "hydroxide" not including CO_3, NO_2, NO_3, PO_4, SO_4, and SiO_3.

Table 3-2. Best-Basis Inventory Estimates for Radioactive Components in Tank 241-AW-104, Decayed to January 1, 1994 (Effective May 31, 1998). (3 sheets)

Analyte	Total inventory (Ci)	Basis (S, M, or E)	Comment
^{3}H	0.741	M	
^{14}C	0.0607	M	
^{59}Ni	0.00582	M	
^{60}Co	0.138	M	
^{63}Ni	0.618	M	
^{79}Se	0.00687	M	

Table 3-2. Best-Basis Inventory Estimates for Radioactive Components in Tank 241-AW-104, Decayed to January 1, 1994 (Effective May 31, 1998). (3 sheets)

Analyte	Total inventory (Ci)	Basis (S, M, or E)	Comment
^{90}Sr	1,240	E	
^{90}Y	1,240	E	Based on ^{90}Sr data.
^{93}Zr	0.0334	M	
^{93m}Nb	0.0236	M	
^{99}Tc	179	E	
^{106}Ru	9.78	M	
^{113m}Cd	0.188	M	
^{125}Sb	1.96	M	
^{126}Sn	0.0105	M	
^{129}I	8.57E-04	M	
^{134}Cs	0.749	M	
^{137}Cs	261,000	E	
^{137m}Ba	247,000	E	Referenced to ^{137}Cs
^{151}Sm	24.2	M	
^{152}Eu	0.0279	M	
^{154}Eu	1.66	M	
^{155}Eu	4.1	M	
^{226}Ra	2.67E-07	M	
^{227}Ac	1.66E-06	M	
^{228}Ra	5.71E-04	M	
^{229}Th	1.33E-05	M	
^{231}Pa	7.39E-06	M	
^{232}Th	5.84E-05	M	
^{232}U	0.00786	S/E/M	Used engineering-based total uranium inventory and HDW isotopic ratios.
^{233}U	0.0201	S/E/M	Used engineering-based total uranium inventory and HDW isotopic ratios.
^{234}U	11.8	S/E/M	Used engineering-based total uranium inventory and HDW isotopic ratios.

Table 3-2. Best-Basis Inventory Estimates for Radioactive Components in Tank 241-AW-104, Decayed to January 1, 1994 (Effective May 31, 1998). (3 sheets)

Analyte	Total inventory (Ci)	Basis (S, M, or E)	Comment
^{235}U	0.447	S/E/M	Used engineering-based total uranium inventory and HDW isotopic ratios.
^{236}U	0.968	S/E/M	Used engineering-based total uranium inventory and HDW isotopic ratios.
^{237}Np	0.00176	M	
^{238}Pu	142	S/E/M	Used sample-based net alpha inventory and HDW isotopic ratios.
^{238}U	8.07	S/E/M	Used engineering-based total uranium inventory and HDW isotopic ratios.
^{239}Pu	1,150	S/E/M	Used sample-based net alpha inventory and HDW isotopic ratios.
^{240}Pu	350	S/E/M	Used sample-based net alpha inventory and HDW isotopic ratios.
^{241}Am	0.588	S/E/M	Used sample-based net alpha inventory and HDW isotopic ratios.
^{241}Pu	14,500	S/E/M	Used sample-based net alpha inventory and HDW isotopic ratios.
^{242}Cm	0.00267	S/E/M	Used sample-based net alpha inventory and HDW isotopic ratios.
^{242}Pu	0.0542	S/E/M	Used sample-based net alpha inventory and HDW isotopic ratios.
^{243}Am	9.83E-05	S/E/M	Used sample-based net alpha inventory and HDW isotopic ratios.
^{243}Cm	4.20E-04	S/E/M	Used sample-based net alpha inventory and HDW isotopic ratios.
^{244}Cm	0.00202	S/E/M	Used sample-based net alpha inventory and HDW isotopic ratios.

Note:
S = sample-based, M = HDW model-based (Agnew et al. 1997a), and E = engineering assessment-based.

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4.0 RECOMMENDATIONS

Push-mode core samples were taken in 1997 to resolve issues regarding tank 241-AW-104. The safety screening DQO issues of energetics, flammable gas, and criticality were satisfied because all observed exotherms were below 480 J/g (dry weight), flammable gas measurements in the tank headspace were 0 percent of the lower flammability limit, and all total alpha results were well below 36.4 μCi/g or 61.5 μCi/mL.

Analyses for the flammable gas DQO were not performed on the 1997 core samples because the sampling and analysis preceded the DQO (Bauer and Jackson 1997). The DQO analyses should be performed opportunistically during the next sampling and analysis event. No vapor samples were taken to estimate the organic pool size. However, because the organic program is expected to close the organic solvents issue in fiscal year 1998, no vapor samples are required. A waste compatibility assessment has not been performed using data from the 1997 sampling. Such an assessment will be needed before waste is received into or removed from the tank. Finally, no samples or specific analyses have been requested to date for the privatization issue. Such sampling and analysis will be performed as privatization needs dictate.

Table 4-1 summarizes the Project Hanford Management Contractor (PHMC) TWRS Program review status and acceptance of the sampling and analysis results reported in this TCR. All issues required to be addressed by sampling and analysis are listed in column 1 of Table 4-1. Column 2 indicates by "yes" or "no" whether the sampling and analysis performed met the issue requirements. Column 3 indicates concurrence and acceptance by the PHMC/TWRS program responsible for the applicable issue. A "yes" in column 3 indicates that no additional sampling or analysis is needed. Conversely, “no” indicates additional sampling or analysis may be needed to satisfy issue requirements.

Table 4-1. Acceptance of Tank 241-AW-104 Sampling and Analysis.

Issue	Sampling and Analysis Performed	Program[1] Acceptance
Safety screening DQO	Yes	Yes
Flammable gas DQO	No[2] (None pending)	n/a
Organic solvents DQO	No[3]	n/a
Waste compatibility DQO	No[4] (None pending)	n/a
Privatization DQO	No[5] (None pending)	n/a

Notes:

n/a = not applicable

[1]PHMC TWRS Program Office

[2]The flammable gas DQO analyses should be performed opportunistically during the next sampling and analysis event.

[3]The organic solvents issue is expected to be closed in fiscal year 1998. The PHMC TWRS safety program has determined that additional sampling is not required to close this issue for this tank.

[4]A waste compatibility assessment has not been performed using the 1997 core sampling data. An assessment will be done when waste is scheduled to be transferred into or out of the tank.

[5]No samples or specific analyses have been requested at this time for the privatization issue; such sampling and analysis will be performed as privatization needs dictate.

Table 4-2 summarizes the status of PHMC TWRS Program review and acceptance of the evaluations and other characterization information contained in this report. Column 1 lists the different evaluations performed in this report. Column 2 shows whether issue evaluations have been completed or are in progress. Column 3 indicates concurrence and acceptance with the evaluation by the PHMC/TWRS program responsible for the applicable issue. A "yes" indicates that the evaluation is completed and meets all issue requirements.

Table 4-2, column 2, contains a "no" for the flammable gas DQO because analyses required by the DQO have not yet been performed. These analyses should be performed opportunistically during the next sampling and analysis event for tank 241-AW-104. Because the organic solvents issue was not evaluated during the 1997 sampling event, a "no" entry is made in column 2 for that issue. However, as discussed in Section 2.2, this issue is expected to be closed in fiscal year 1998 and an evaluation will not be performed for this tank.
Table 4-2, column 2, contains a "no" for the waste compatibility DQO because a waste compatibility assessment using the 1997 data has not been performed for the transfer of liquid

from the tank. A waste compatibility assessment will be done when the next transfer is scheduled. The privatization DQO also is marked with a "no" because an evaluation for this issue has not been performed to date using the results of the 1997 sampling event. This assessment will be performed in the future as privatization needs dictate.

Table 4-2. Acceptance of Evaluation of Characterization Data and Information for Tank 241-AW-104.

Issue	Evaluation Performed	TWRS[1] Program Acceptance
Safety screening DQO	Yes	Yes
Flammable gas DQO	No	n/a
Organic solvents DQO	No	n/a
Waste compatibility DQO	No	n/a
Privatization DQO	No	n/a

Note :
[1]PHMC TWRS Program Office

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APPENDIX A

HISTORICAL TANK INFORMATION

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APPENDIX A

HISTORICAL TANK INFORMATION

Appendix A describes tank 241-AW-104 based on historical information. For this report, historical information includes any information about the fill history, waste types, surveillance, or modeling of the tank. This information often is useful for supporting or challenging conclusions based on sampling and analysis.

This appendix contains the following information:

- **Section A1**: Current status of the tank, including the current waste levels, as well as the stabilization and isolation status of the tank.
- **Section A2**: Information about the tank design.
- **Section A3**: Process knowledge of the tank; i.e., the waste transfer history and the estimated contents of the tank based on modeling data.
- **Section A4**: Surveillance data for tank 241-AW-104, including surface-level readings, temperatures, and a description of the waste surface based on photographs.
- **Section A5**: References for Appendix A.

Historical sampling results (results from samples obtained before 1989) are included in Appendix B.

A1.0 CURRENT TANK STATUS

As of May 31, 1998, tank 241-AW-104 contained an estimated 4,235 kL (1,119 kgal) of waste classified as dilute non-complexed waste (Hanlon 1998). The liquid volume was estimated using an ENRAF[1] gauge and a manual tape. The solid volume was estimated using a sludge-level measuring device. The volume of the waste phases found in the tank are shown in Table A1-1.

[1]ENRAF is a trademark of ENRAF Corporation, Houston, Texas.

Tank 241-AW-104 is still in service and is categorized as sound. This actively ventilated tank is not on the Watch List (Public Law 101-510). All monitoring systems were in compliance with documented standards as of May 31, 1998 (Hanlon 1998).

Table A1-1. Tank Contents Status Summary.[1]

Waste type	Estimated Volume	
	kL	kgal
Total waste	4,235	1,119
Supernatant	3,361	888
Sludge	590	156
Saltcake	284	75
Drainable interstitial liquid	114	30
Drainable liquid remaining	3,475	918
Pumpable liquid remaining	3,391	896

Note:
[1]For definitions and calculation methods refer to Appendix C of Hanlon (1998).

A2.0 TANK DESIGN AND BACKGROUND

The AW Tank Farm was constructed from 1978 to 1980 in the 200 East Area. The tank farm contains six double-shell tanks. Each tank has a capacity of 4,390 kL (1,160 kgal), a diameter of 22.9 m (75.0 ft), and an operating depth of 10.5 m (34.5 ft). These tanks were designed to hold concentrated supernatant. The maximum design temperature for liquid storage is 177 °C (350 °F) (Brevick et al. 1997).

Tank 241-AW-104 was constructed with a primary carbon steel inner liner (heat-treated and stress-relieved), a secondary carbon steel outer liner (not heat treated), and a reinforced concrete shell. The bottom of the primary liner is 13 mm (0.5 in.) thick, the lower portion of the sides is 19 mm (0.75 in.) thick, the upper portion of the sides is 13 mm (0.5 in.) thick, and the dome liner is 9.5 mm (0.375 in.) thick. The secondary liner is 9.5 mm (0.375 in.) thick. The concrete walls are 460 mm (1.5 ft) thick and the dome is 380 mm (1.25 ft) thick. The tank has a flat bottom. The bottom of the primary and secondary liners are separated by an insulating concrete layer. A grid of drain slots in the concrete foundation beneath the secondary steel liner collects any waste that may leak from the tank and diverts it to the leak detection well.

Tank 241-AW-104 has 22 risers ranging in diameter from 100 mm (4 in.) to 1.1 m (42 in.) that provide access to the tank and 37 risers that provide access to the annulus. Table A2-1 shows numbers, diameters, and descriptions of the risers, except the annulus risers. Figure A2-1 is a plan view of the riser configuration. Five 100-mm (4-in.) diameter risers (nos. 1B, 10A, 13A, 15A, and 16A), and two 305-mm (12-inch) diameter risers (nos. 7B and 12A) are tentatively available for sampling the tank interior. Four 100-mm (4-in.) diameter risers (nos. 1C, 13B, 16B, and 16C) are alternative risers tentatively available for sampling the tank interior (Lipnicki 1997). Figure A2-2 is a tank cross-section showing the approximate waste level along with a schematic of the tank equipment.

Figure A2-1. Riser Configuration for Tank 241-AW-104.

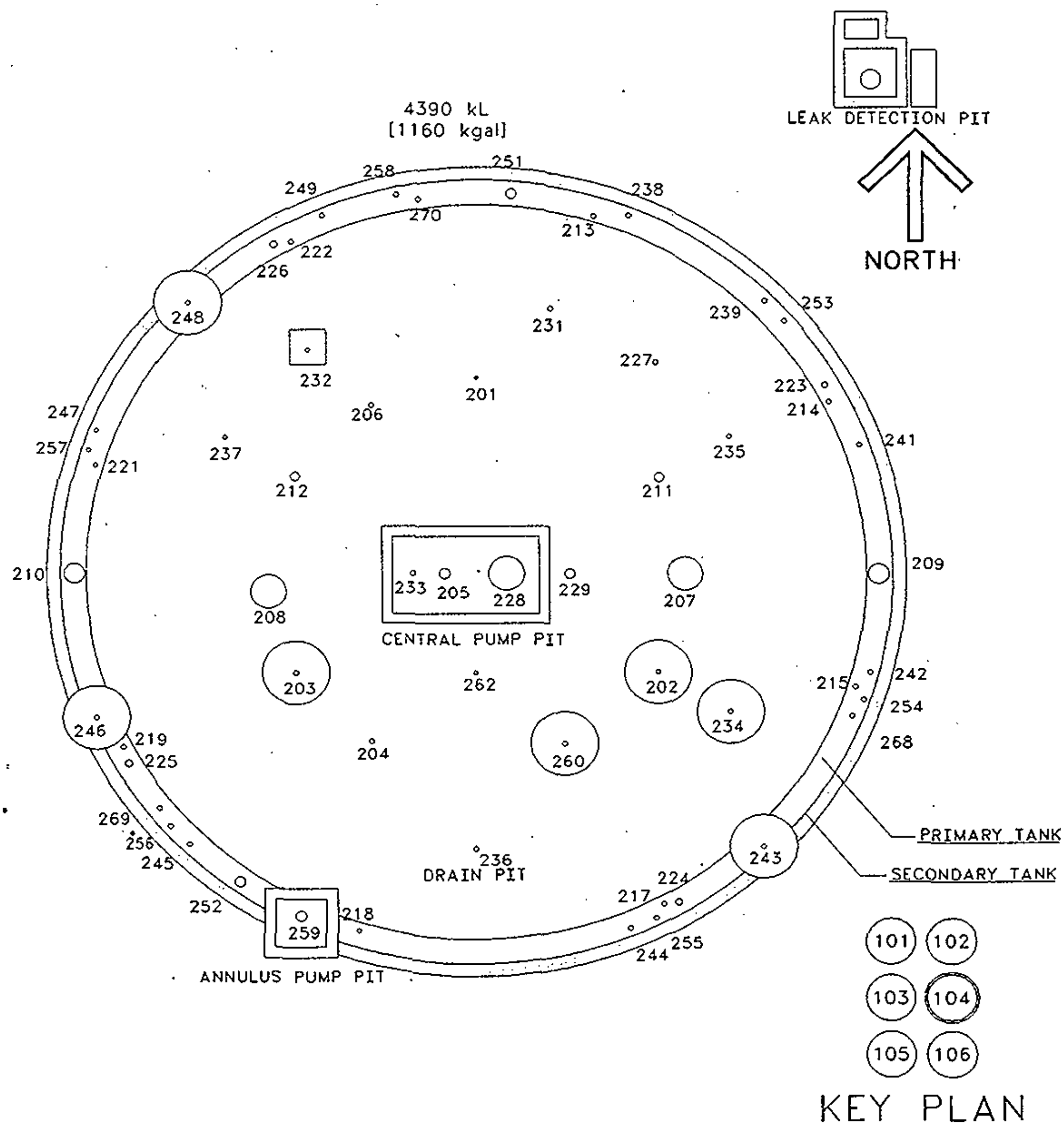


Table A2-1. Tank 241-AW-104 Risers.[1]

New Number	Number	Diameter (in.)	Description and Comments
201	1A	4	Liquid level indicator (manual tape)
202[2]	1B	4	Sludge measurement port/spare, P/CP (12 in. cover)
203	1C	4	Sludge measurement port/spare
204	2A	4	Tank level indicator (ENRAF™)
205	3A	12	Supernatant pump
206	4A	4	Thermocouple probe
207	5A	42	Construction opening/spare
208	5B	42	Construction opening/spare (4 Flange cover with/ camera and Equipment Engineering Change Notice 613265 January 25, 1995)
211	7A	12	Vent (Tank air outlet controller Engineering Change Notice 624519 February 27, 1996)
212[2]	7B	12	Spare (Tank air inlet controller Engineering Change Notice 624519 February 27, 1996)
227[2]	10A	4	Spare, P/CP (12 in. cover)
228	11A	42	Slurry distributor
229[2]	12A	12	Observation port/spare
231[2]	13A	4	Sludge measurement port/spare
232	13B	4	Tank pressure, P/CP (24 in. cover)
233	14A	4	Central pump pit droplet nozzle supernatant return
234[2]	15A	4	Spare, P/CP (12 in. cover) (Multi-functional instrument tree Engineering Change Notice 612557 August 14, 1995)
235[2]	16A	4	Sludge measurement port/spare, P/CP (12 in. cover)
236	16B	4	Tank pressure indicator
237	16C	4	Sludge measurement port/spare
260	21A	4	High level sensor, P/CP (12 in. cover)
262	22A	4	Liquid observation well
268	27A	4	Leak detector zone 4
269	27B	4	Leak detector zone 2
270	27C	4	Leak detector zone 3

Notes:

[1]Salazar (1994), Tran (1993), LMHC (1997), WHC (1995)

[2]Denotes risers tentatively available for sampling (Lipnicki 1997).

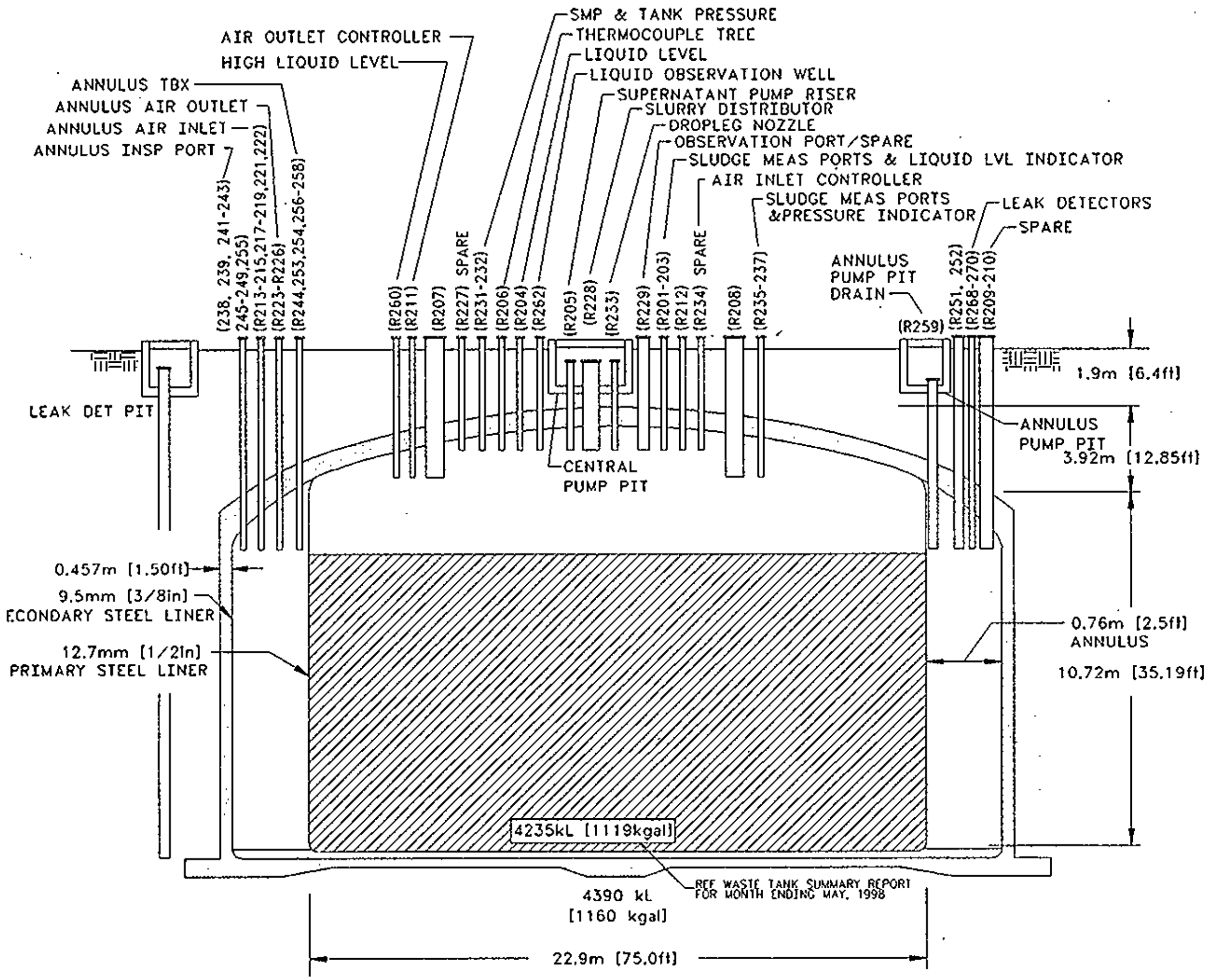


Figure A2-2. Tank 241-AW-104 Cross Section and Schematic.

A3.0 PROCESS KNOWLEDGE

The following sections 1) provide information about the transfer history of tank 241-AW-104, 2) describe the process wastes that made up the transfers, and 3) give an estimate of the current tank contents based on transfer history.

A3.1 WASTE TRANSFER HISTORY

Table A3-1 summarizes the waste transfer history of tank 241-AW-104 based on Agnew et al. (1997b) from startup to the fourth quarter of 1988 and on the Hanford Site tank transfer database (LMHC 1998) from 1989 to May 1998. Tank 241-AW-104 entered service in 1980 by receiving dilute caustic solution waste. In 1981, the tank received waste from tank 241-AY-101.

Beginning in 1982 and continuing throughout its transfer history, the tank was used to support 242-A Evaporator operation. From the third quarter of 1982 to the first quarter of 1986, dilute noncomplexed waste was transferred to the tank from tank 241-AW-102 as 242-A Evaporator bottoms. Supernatant waste was transferred to the 242-A Evaporator through tank 241-AW-102 as 242-Evaporator feed from the third quarter of 1982 to the first quarter of 1989. Dilute non-complexed waste was transferred from the tank to tank 241-AW-105 in the third quarters of 1982 and 1983. From the fourth quarter of 1982 to the first quarter of 1983, the tank received decladding waste from the PUREX Facility . In the third quarter of 1983 supernatant waste was transferred to the tank from tank 241-AZ-101. In the fourth quarter of 1982 and from the third quarter of 1986 to the second quarter of 1991, the tank received PUREX low-level waste. Throughout its transfer history, the tank has received periodic additions of flush water from miscellaneous sources.

Table A3-1. Tank 241-AW-104 Major Transfers.[1]

Transfer Source	Transfer Destination	Waste Type	Time Period	Estimated Waste Volume[2]	
				kL	kgal
Dilute Caustic Solution	-	Dilute caustic	1980	34	9
241-AY-101	-	Supernatant	1981	541	143
241-AW-102	-	242-A Evaporator bottoms	1982 - 1986	33,750	8,915
-	241-AW-102	242-A Evaporator feed	1982 - 1989	53,310	14,083
-	241-AW-105	Dilute, non-complexed	1982, 1983	447	118
PUREX	-	Decladding waste	1982 - 1983	180	47
241-AZ-101	-	Supernatant	1983	3,410	902
PUREX	-	PUREX low-level waste	1982, 1986 - 1991	16,900	4,464
Miscellaneous Sources	-	Flush water	1982 - 1998	2,740	725

Notes:

[1]Data are from Agnew et al. (1997b) before 1989, and from the Operational Waste Volume Projection database (LMHC 1998) thereafter. Volume changes caused by evaporation are not included.

[2]Because only major transfers are listed, the sum of these transfers will not equal the current waste volume.

A3.2 HISTORICAL ESTIMATION OF TANK CONTENTS

The historical transfer data used for this estimate are from the following sources:

- The *Waste Status and Transaction Record Summary (WSTRS Rev. 4)*, (Agnew et al. 1997b) is a tank-by-tank quarterly summary spreadsheet of waste transactions.

- The *Hanford Tank Chemical and Radionuclide Inventories: HDW Model Rev. 4* (Agnew et al. 1997a) contains the HDW list, the SMM, the TLM, and the historical tank content estimate.

- The HDW list consists of approximately 50 waste types, defined by concentration, for major analytes and compounds for sludge and supernatant layers.

- The TLM defines the sludge and saltcake layers in each tank using waste composition and waste transfer information.

- The SMM is a subroutine within the HDW model that calculates the volume and composition of certain supernatant blends and concentrates.

Using these records, the TLM defines the sludge and saltcake layers in each tank. The SMM uses information from the WSTRS, the TLM, and the HDW list to describe the supernatants and concentrates in each tank. Together the WSTRS, TLM, SMM, and HDW list determine the inventory estimate for each tank. These model predictions are considered estimates that require further evaluation using analytical data.

These models have not been updated for waste transfers since January 1, 1994. The volume of waste in tank 241-AW-104 was 4,240 kL (1,120 kgal) in January 1994, and the current volume as of May 31, 1998 is 4,235 kL (1,119 kgal). Because the values are within one kgal, the Tank Layer Model and Historical Tank Inventory Estimate should still be representative of the current tank contents.

Based on the TLM and SMM, tank 241-AW-104 contains four layers. A top layer of 3,150 kL (833 kgal) of supernatant is predicted to be above 708 kL (187 kgal) of supernatant mixing model 242-A Evaporator concentrate from 1981 to present (SMMA2), over a layer of 371 kL (98 kgal) of PUREX low-level waste (PL2), over a bottom layer of 19 kL (5 kgal) of zirconium coating waste (CWZr2). Figure A3-1 is a graphical representation of the estimated waste type and volume for the tank layer.

The CWZr2 layer should contain from highest concentration above 1 weight percent, the following major constituents: sodium, fluoride, hydroxide, zirconium, nitrate, and iron. Constituents contained in this layer above 0.1 weight percent are calcium, potassium, carbonate, ammonia, and uranium. The PL2 layer should contain from highest concentration above 1 weight percent, the following major constituents: hydroxide, iron, carbonate, calcium, nitrate, uranium, and sodium. Constituents contained in this layer above 0.1 weight percent are nickel and phosphate. No specific constituents are currently available for the SMMA2 layer. Table A3-2 shows the historical estimate of the expected waste constituents and their concentrations. See Appendix D for a more current assessment of tank 241-AW-104 contents using the HDW model as one of the inputs.

Figure A3-1. Tank Layer Model.

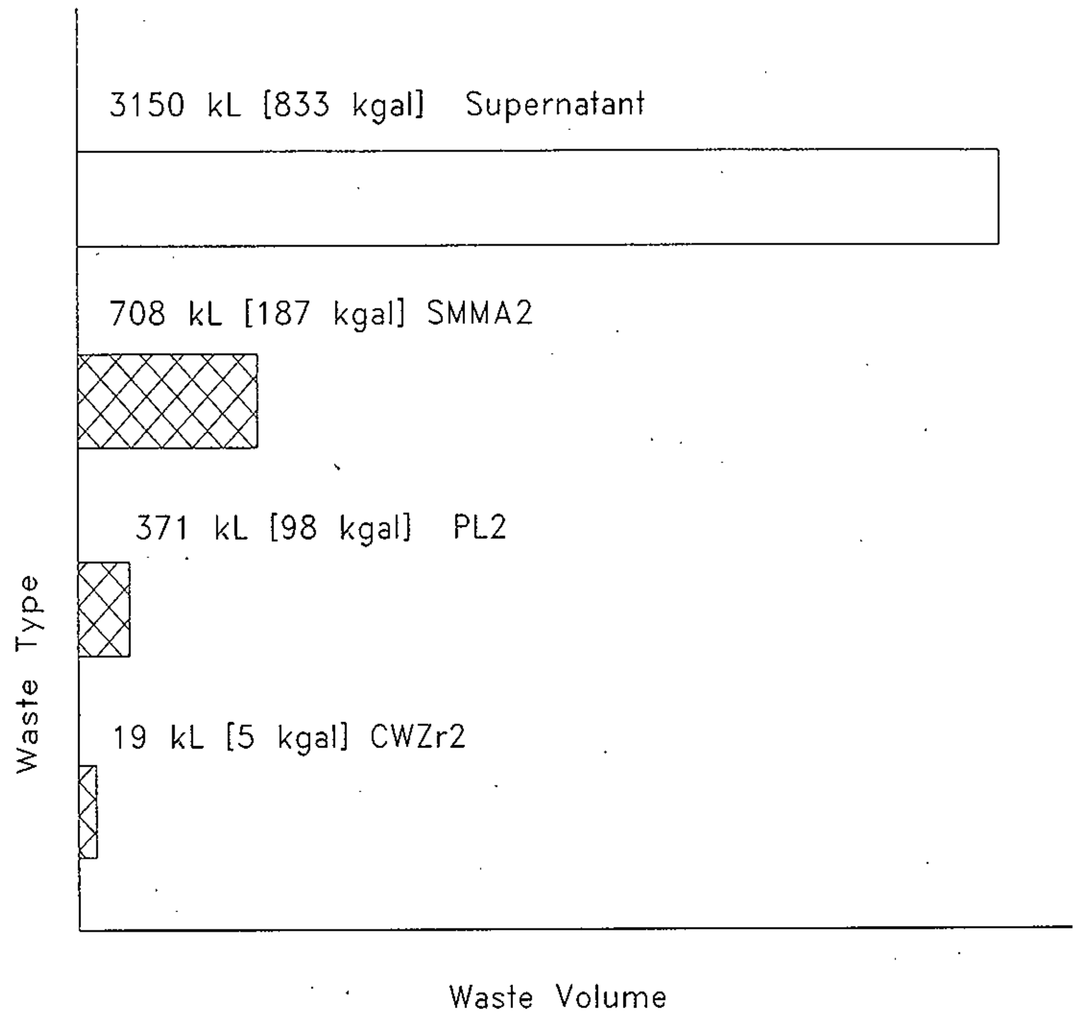


Table A3-2. Historical Tank Inventory Estimate.[1,2,3] (4 sheets)

Total Inventory Estimate					
Physical Properties				**-95 CI**	**+95 CI**
Total waste	4.42E+06 (kg) (1.12E+03 kgal)			----	----
Heat load	4.32E-03 (kW) (14.8 BTU/hr)			3.30E-03	5.33E-03
Bulk density[4]	1.04 (g/cc)			1.02	1.06
Water wt%[4]	93.2			90.6	96.2
TOC wt% C (wet)[4]	4.38E-02			1.94E-02	6.76E-02
Constituents	**M**	**ppm**	**kg[5]**	**-95 CI**	**+95 CI**
Na^{+}	0.614	1.36E+04	6.00E+04	0.277	0.952
Al^{3+}	6.59E-04	17.1	75.5	5.70E-04	6.99E-04
Fe^{3+}	0.169	9.09E+03	4.02E+04	0.157	0.172
Cr^{3+}	7.34E-03	367	1.62E+03	3.13E-03	1.16E-02
Bi^{3+}	4.75E-07	9.55E-02	0.422	4.48E-07	5.05E-07
La^{3+}	6.72E-09	8.98E-04	3.97E-03	4.96E-09	8.49E-09
Hg^{2+}	9.34E-06	1.80	7.97	1.88E-08	9.55E-06
Zr	4.13E-03	362	1.60E+03	6.67E-06	4.19E-03
Pb^{2+}	4.01E-05	7.99	35.3	1.73E-05	6.30E-05
Ni^{2+}	1.13E-02	636	2.81E+03	1.55E-03	1.41E-02
Sr^{2+}	0	0	0	0	0
Mn^{4+}	5.47E-03	289	1.28E+03	2.32E-03	9.57E-03
Ca^{2+}	4.80E-02	1.85E+03	8.19E+03	7.39E-03	6.24E-02
K^{+}	7.17E-03	270	1.19E+03	3.57E-03	1.08E-02
OH^{-}	0.605	9.90E+03	4.37E+04	0.510	0.664
NO^{3-}	0.238	1.42E+04	6.26E+04	0.103	0.373
NO^{2-}	1.00E-02	444	1.96E+03	4.78E-03	1.53E-02
CO_3^{2-}	0.141	8.16E+03	3.60E+04	4.70E-02	0.209
PO_4^{3-}	6.34E-02	5.80E+03	2.56E+04	2.69E-02	0.100
SO_4^{2-}	3.79E-03	351	1.55E+03	1.67E-03	5.92E-03
Si	3.25E-05	0.878	3.88	2.77E-05	3.70E-05
F^{-}	2.36E-02	432	1.91E+03	7.61E-05	2.87E-02
Cl^{-}	3.68E-03	126	554	1.63E-03	5.74E-03

Table A3-2. Historical Tank Inventory Estimate.[1,2,3] (4 sheets)

Total Inventory Estimate					
Constituents (Cont'd)	M	ppm	kg[3]	-95 CI	+95 CI
$C_6H_5O_7^{3-}$	1.39E-05	2.53	11.2	1.16E-05	1.62E-05
$EDTA^{4-}$	1.08E-05	2.99	13.2	3.56E-06	1.82E-05
$HEDTA^{3-}$	1.92E-05	5.07	22.4	4.75E-06	3.39E-05
$Glycolate^{-}$	7.97E-05	5.75	25.4	4.87E-05	1.11E-04
$Acetate^{-}$	7.58E-06	0.431	1.90	6.09E-06	9.91E-06
$Oxalate^{2-}$	8.80E-09	7.45E-04	3.29E-03	7.84E-09	9.75E-09
DBP	3.12E-03	630	2.78E+03	1.32E-03	4.91E-03
Butanol	3.12E-03	222	981	1.32E-03	4.91E-03
NH_3	3.12E-03	51.0	225	7.34E-05	6.01E-03
$Fe(CN)_6^{4-}$	0	0	0	0	0
Radiological Constituents	Ci/L	μCi/g	Ci[3]	-95 CI (Ci/L)	+95 CI (Ci/L)
^{3}H	1.74E-07	1.68E-04	0.741	9.33E-08	2.55E-07
^{14}C	1.43E-08	1.37E-05	6.07E-02	8.39E-09	1.53E-08
^{59}Ni	1.37E-09	1.32E-06	5.82E-03	1.09E-09	1.40E-09
^{63}Ni	1.45E-07	1.40E-04	0.618	1.18E-07	1.48E-07
^{60}Co	3.26E-08	3.13E-05	0.138	1.72E-08	4.78E-08
^{79}Se	1.62E-09	1.56E-06	6.87E-03	1.24E-09	1.88E-09
^{90}Sr	6.63E-05	6.38E-02	282	4.67E-05	8.57E-05
^{90}Y	6.63E-05	6.38E-02	282	4.67E-05	8.57E-05
^{93}Zr	7.86E-09	7.56E-06	3.34E-02	5.97E-09	9.19E-09
^{93m}Nb	5.54E-09	5.34E-06	2.36E-02	4.23E-09	6.48E-09
^{99}Tc	1.04E-07	1.00E-04	0.443	8.22E-08	1.32E-07
^{106}Ru	2.30E-06	2.21E-03	9.78	2.29E-06	2.30E-06
^{113m}Cd	4.42E-08	4.25E-05	0.188	3.29E-08	5.22E-08
^{125}Sb	4.62E-07	4.45E-04	1.96	8.89E-08	8.31E-07
^{126}Sn	2.46E-09	2.37E-06	1.05E-02	1.90E-09	2.86E-09
^{129}I	2.02E-10	1.94E-07	8.57E-04	1.59E-10	2.56E-10
^{134}Cs	1.76E-07	1.70E-04	0.749	1.07E-08	3.40E-07
^{137}Cs	1.22E-04	0.117	518	9.87E-05	1.45E-04
^{137m}Ba	1.15E-04	0.111	490	9.33E-05	1.37E-04

Table A3-2. Historical Tank Inventory Estimate.[1, 2, 3] (4 sheets)

Total Inventory Estimate					
Radiological Constituents (Cont'd)	Ci/L	μCi/g	Ci[5]	-95 CI (Ci/L)	+95 CI (Ci/L)
^{151}Sm	5.70E-06	5.48E-03	24.2	4.38E-06	6.63E-06
^{152}Eu	6.56E-09	6.32E-06	2.79E-02	6.10E-09	6.96E-09
^{154}Eu	3.91E-07	3.76E-04	1.66	2.76E-07	5.05E-07
^{155}Eu	9.64E-07	9.28E-04	4.10	8.91E-07	1.04E-06
^{226}Ra	6.28E-14	6.04E-11	2.67E-07	5.04E-14	7.11E-14
^{228}Ra	1.34E-10	1.29E-07	5.71E-04	4.80E-11	1.70E-10
^{227}Ac	3.91E-13	3.76E-10	1.66E-06	3.19E-13	4.39E-13
^{231}Pa	1.74E-12	1.67E-09	7.39E-06	1.36E-12	2.01E-12
^{229}Th	3.12E-12	3.00E-09	1.33E-05	1.12E-12	3.89E-12
^{232}Th	1.37E-11	1.32E-08	5.84E-05	3.07E-12	1.95E-11
^{232}U	6.49E-10	6.24E-07	2.76E-03	4.88E-10	8.13E-10
^{233}U	1.66E-09	1.60E-06	7.07E-03	1.22E-09	2.21E-09
^{234}U	9.70E-07	9.34E-04	4.12	2.46E-07	1.71E-06
^{235}U	3.69E-08	3.55E-05	0.157	9.34E-09	6.49E-08
^{236}U	7.99E-08	7.69E-05	0.339	2.02E-08	1.41E-07
^{238}U	6.66E-07	6.41E-04	2.83	1.69E-07	1.17E-06
^{237}Np	4.14E-10	3.98E-07	1.76E-03	3.42E-10	5.05E-10
^{238}Pu	2.56E-05	2.47E-02	109	1.94E-05	2.82E-05
^{239}Pu	2.08E-04	0.200	882	1.57E-04	2.28E-04
^{240}Pu	6.31E-05	6.07E-02	268	4.78E-05	6.93E-05
^{241}Pu	2.62E-03	2.52	1.11E+04	1.98E-03	2.88E-03
^{242}Pu	9.76E-09	9.39E-06	4.15E-02	7.39E-09	1.07E-08
^{241}Am	1.06E-07	1.02E-04	0.450	2.90E-08	5.11E-07
^{243}Am	1.77E-11	1.70E-08	7.53E-05	1.50E-12	1.03E-10
^{242}Cm	4.81E-10	4.63E-07	2.04E-03	4.45E-10	5.16E-10
^{243}Cm	7.57E-11	7.29E-08	3.22E-04	6.98E-11	8.16E-11
^{244}Cm	3.63E-10	3.49E-07	1.54E-03	6.81E-11	2.08E-09

Table A3-2. Historical Tank Inventory Estimate.[1,2,3] (4 sheets)

Total Inventory Estimate					
Totals	M	μg/g	kg	-95 CI (M or g/L)	+95 CI (M or g/L)
Pu	3.65E-03 (g/L)	----	15.5	2.76E-03	4.01E-03
U	8.40E-03	1.92E+03	8.50E+03	2.13E-03	1.48E-02

Notes:

CI = Confidence interval

[1]Agnew et al. (1997a)

[2]These predictions have not been validated and should be used with caution.

[3]Unknowns in tank solids inventory are assigned by the TLM.

[4]This is the volume average for density, mass average water weight percent and TOC weight percent carbon.

[5]Differences exist among the inventories in this column and the inventories calculated from the two sets of concentrations.

A4.0 SURVEILLANCE DATA

Tank 241-AW-104 surveillance consists of surface-level measurements (liquid and solid), temperature monitoring inside the tank (waste and headspace), and annulus instrumentation for monitoring conditions outside the primary tank. Surveillance data from these various systems provide the basis for determining tank integrity. The principal means of detecting potential leaks from the primary (inner) tank are the conductivity probe and radiation monitor located in the tank annulus. Additional instrumentation in the tank leak-detection pit, consisting of radiation monitors, specific-gravity probes, and thermocouples, indicate potential leaks from the secondary (outer) tank. However, as of May 31, 1998, the leak-detection radiation monitors were no longer in use (as is the case for all double-shell tanks except the SY farm) and the specific-gravity probes were out of service (Hanlon 1998). Solid surface level measurements indicate physical changes in and consistencies of the solid layers of a tank.

A4.1 SURFACE-LEVEL READINGS

Waste surface level monitoring is performed with an ENRAF™ gauge or manual tape. Before January 1996 a Food Instrument Corporation (FIC) gauge was used to measure surface level.

The FIC has been replaced by an ENRAF™ gauge used to monitor the surface level through riser 2A. The waste surface level on May 31, 1998, from the ENRAF™ gauge was 10.33 m (406.86 in.), and from the manual tape was 10.32 m (406.25 in.). Figure A4-1 shows the volume measurements as a level history graph.

A4.2 INTERNAL TANK TEMPERATURES

Temperature data for tank 241-AW-104 are recorded by 18 thermocouples on 1 thermocouple tree located in riser 4A. Temperature data are available from the Surveillance Analysis Computer System recorded from July 10, 1989, to May 31, 1998. The average temperature during this period was 24.9°C (76.8 °F); the minimum was 14.4°C (58°F) and the maximum was 39.4°C (103°F). Currently, temperature readings are only available for thermocouples 1, 2, 3, 5, 7, 11, and 17.

From May 31, 1997, to May 31, 1998, the average temperature was 21.5 °C (70.7 °F) with a minimum of 16.6 °C (61.9 °F) and a maximum of 26.7 °C (80.0 °F). The minimum temperature on May 25, 1998, was 17.8 °C (64 °F) at thermocouples 11 and 17; the maximum temperature on the same date was 24.4 °C (76 °F) at thermocouple 3. A graph of the weekly high temperatures can be found in Figure A4-2. Plots of the thermocouple readings can be found in the *Supporting Document for the Historical Tank Content Estimate for AW Tank Farm* (Brevick et al. 1997).

A4.3 TANK ANNULUS LEAK DETECTION

The principal means of detecting potential leaks from the primary (inner) tank are a conductivity probe and radiation monitor located in the tank annulus (Jensen 1997 and Welty 1988). Data from the conductivity probe and radiation monitor are manually recorded on data sheets once per shift. Alarms from the leak detection monitors are automatically transmitted to the Computer Automated Surveillance System. Surveillance equipment alarms and any malfunctions are reported in weekly East Area tank farm equipment/anomaly reports. The annulus monitoring has not indicated any leaks from the primary (inner) tank.

A4.4 TANK 241-AW-104 PHOTOGRAPHS

The February 1983 photographic montage of tank 241-AW-104's interior shows liquid at a much lower level than currently (Brevick et al. 1997). The liquid appears to be murky brown in the middle with yellow and black solid particles suspended on the surface. Various pieces of equipment are visible. The waste level has changed since the photographs were taken; therefore the photographic montage may not represent the current appearance of the tank's waste.

Figure A4-1. Tank 241-AW-104 Level History.

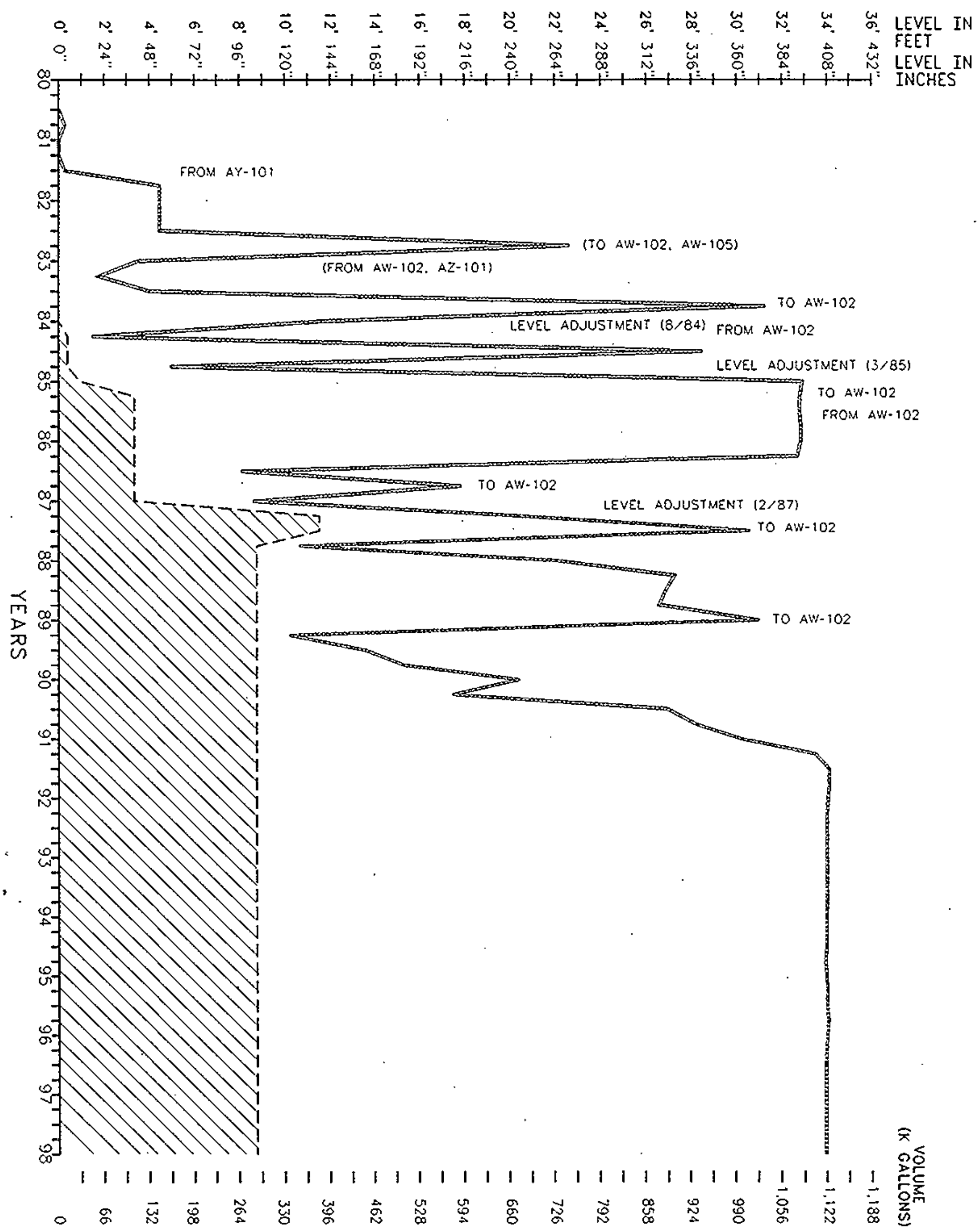
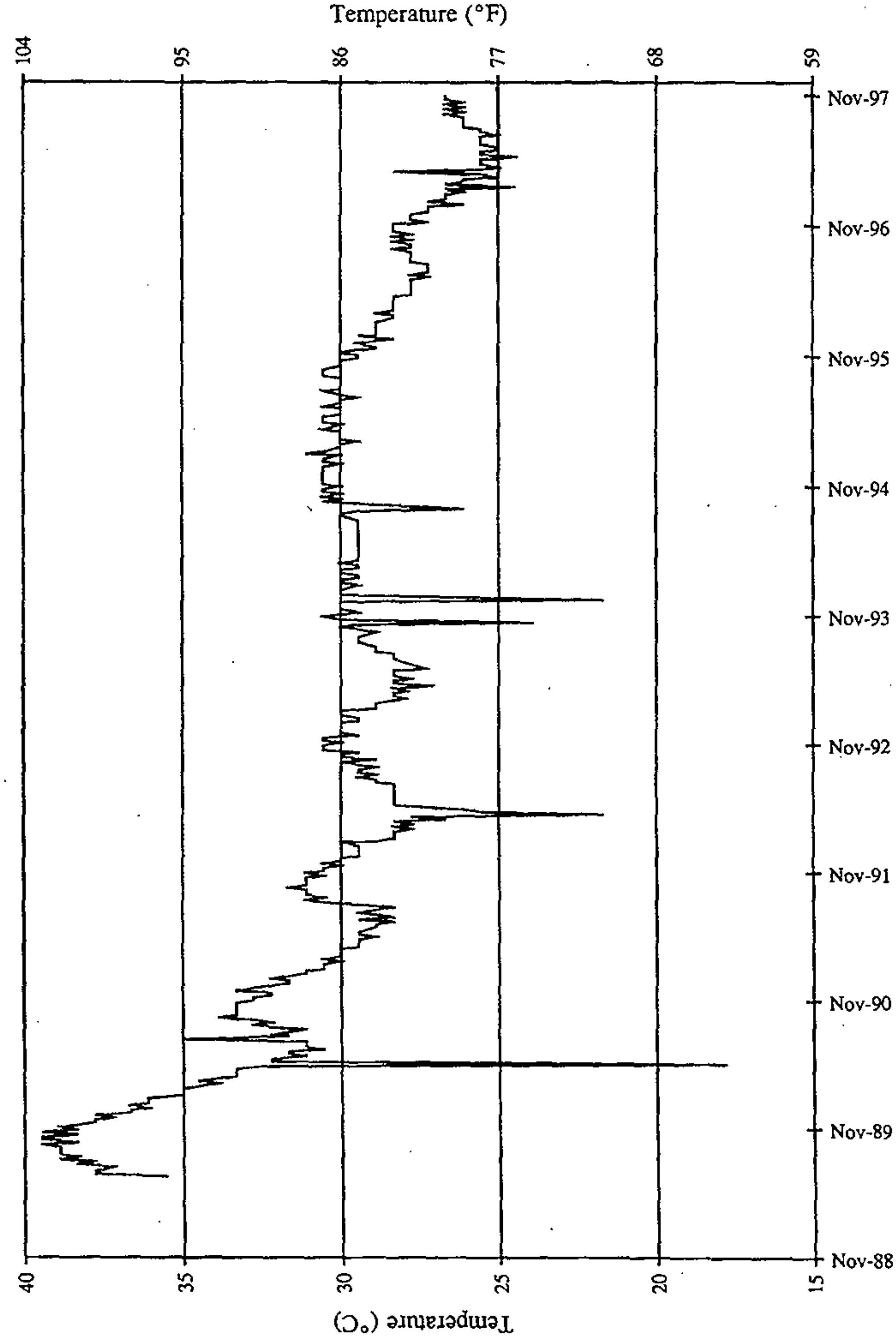


Figure A4-2. Tank 241-AW-104 High Temperature Plot.



A5.0 APPENDIX A REFERENCES

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APPENDIX B

SAMPLING OF TANK 241-AW-104

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APPENDIX B

SAMPLING OF TANK 241-AW-104

Appendix B provides sampling and analysis information for each known sampling event for tank 241-AW-104 and assesses the core sample results. It includes the following:

- **Section B1.0**: Tank Sampling Overview
- **Section B2.0**: Sampling Events
- **Section B3.0**: Assessment of Characterization Results
- **Section B4.0**: References for Appendix B

B1.0 TANK SAMPLING OVERVIEW

This appendix describes the sampling and analysis events for tank 241-AW-104. Push mode core samples were taken and a combustible gas test was performed in June 1997 to satisfy the requirements of the *Tank Safety Screening Data Quality Objective* (Dukelow et al. 1995) and the *Implementation Change Concerning Organic DQO, Rev. 2* (Meacham 1996). The sampling and analyses were performed in accordance with the *Tank 241-AW-104 Push Mode Core Sampling and Analysis Plan* (Benar 1997). These analyses are discussed in Section B2.1. Grab samples were taken from tank 241-AW-104 in September 1994 to satisfy the compatibility requirements of *Data Quality Objectives for the Waste Compatibility Program* (Carothers 1994). The grab sampling and analyses were performed in accordance with "Letter of Instruction for Analysis of Double-Shell Tank 241-AW-104 Grab Samples" (Bratzel 1994), and are discussed in Section B2.2.

Several historical samples were collected from 1980 to 1986. These sampling events are discussed in Section B2.4.

B2.0 SAMPLING EVENTS

This section describes sampling events and analytical results for tank 241-AW-104. Tables B2-9 through B2-61 show analytical results. The analytical results used to characterize current tank contents were from the 1997 core sample. Results from a 1994 grab sampling event are used for corroboration with the drainable liquid results from the 1997 event. Historical sample results are presented in Section B2.4. Table B2-1 summarizes the sampling and analytical requirements from the applicable DQOs for the core and grab sampling events.

Table B2-1. Integrated Data Quality Objective Requirements for the Tank 241-AW-104 Sampling Events.

Sampling Event	Applicable DQOs	Sampling Requirements	Analytical Requirements
Push mode core sampling[1]	Safety screening - Energetics - Moisture content - Total alpha - Flammable gas Dukelow et al. (1995)	Core samples from a minimum of two risers separated radially to the maximum extent possible. Combustible gas measurement	Flammability, energetics, moisture, total alpha activity, density, anions, cations, TOC[2]
Grab sampling[3]	Compatibility Carothers (1994)	Grab samples	Energetics, moisture, anions, cations, radionuclides, specific gravity, pH, separable organics, TOC, TIC, percent solids

Notes:

TIC = total inorganic carbon
TOC = total organic carbon

[1]Benar 1997

[2]TOC measurements are required on only those samples that display exothermic behavior as directed by *Implementation Change Concerning Organic DQO, Rev. 2* (Meacham 1996).

[3]Bratzel 1994

B2.1 DESCRIPTION OF 1997 PUSH MODE CORE SAMPLING EVENT

The intent of the 1997 push mode core sampling event was to obtain two vertical profiles of the tank solids layer only. Waste volume records at the time of sampling indicated that although tank 241-AW-104 contained a total of 1,030 cm (406 in.) of waste, only approximately 366 cm (144 in.) of solids existed in the bottom of tank. Therefore, eight segments were required for each core sample.

The two push mode core samples were collected in June 1997. Core 204 was removed from riser 13A between June 19 and June 23; core 206 was removed from riser 15A on June 24 and 25. The only problem noted during sampling was a failure of the sampler while taking segment 19 of core 204 (Steen 1997). The segment was successfully retaken and assigned the number 19R. A lithium bromide solution was added after two segments were removed to clean the drill string.

The eight segments (numbered segment 15 through segment 22) from each core were received, extruded, and analyzed by the 222-S Laboratory. The analyses were directed by the *Tank 241-AW-104 Push Mode Core Sampling and Analysis Plan* (Benar 1997), and were consistent with the *Tank Safety Screening Data Quality Objective* (Dukelow et al. 1995). In addition, TOC measurements were performed for those samples that exhibited exothermic behavior as required by *Implementation Change Concerning Organic DQO, Rev. 2* (Meacham 1996).

A vertical profile is used to satisfy the safety screening DQO (Dukelow et al. 1995). Safety screening analyses include total alpha activity to determine criticality, DSC to ascertain the fuel energy value, and thermogravimetric analysis (TGA) to obtain the total moisture content. In addition, combustible gas meter readings in the tank headspace were performed to measure tank headspace flammability. The safety screening DQO also requires bulk density measurements. Table B2-1 summarizes the sampling and analytical requirements from the safety screening DQO.

B2.1.1 Sample Handling

The push mode samples were shipped to the 222-S Laboratory for subsampling and analysis. Samples were assigned LABCORE numbers and were subjected to visual inspection for color, clarity, solids content, and the presence of a separable organic layer. The radiation dose rate on contact also was measured. Drainable liquid was collected and filtered. If sufficient solids were recovered from a segment, they were divided into upper- and lower-half segments. No core composites were created. Sample extrusion and subsampling information for the two cores is presented in Table B2-2.

A field blank was provided to the 222-S Laboratory with core 204. It underwent the same analysis as the drainable liquid as instructed by the sampling and analysis plan (SAP) (Benar 1997). A sample of the hydrostatic head fluid (a lithium bromide solution) also was provided with core 204; this sample was analyzed by ion chromatography (IC) and inductively coupled plasma spectrometry (ICP).

Table B2-2. Tank 241-AW-104 Subsampling Scheme and Sample Description. (2 sheets)

Core	Segment	Sample Portion	Weight (g)	Sample Characteristics
204	15	Drainable liquid		
204	16	Drainable liquid	276.3	Liquid was yellow in color and clear. Collected 290 mL of liquid. No organic layer was observed.
204	17	Drainable liquid	289.9	Liquid was yellow in color and clear. Collected 290 mL of liquid. No organic layer was observed.
204	18	Lower half	138.9	Solids were brown in color and resembled a sludge slurry. Liquid was brown in color and opaque. Collected 150 mL of liquid. No organic layer was observed.
		Drainable liquid	168.5	
204	19R	Lower half	132.0	Solids were brown in color and resembled a sludge slurry. Liquid was brown in color and opaque. Collected 180 mL of liquid. No organic layer was observed.
		Drainable liquid	229.9	
204	20	Drainable liquid	140.4	Liquid was brown in color and opaque. Collected 110 mL of liquid. No organic layer was observed.
204	21	Upper half	80.3	Solids were dark gray-brown in color and resembled a wet sludge.
		Lower half	271.2	
204	22	Lower half	198.5	Solids were light gray and white in color and resembled a sludge slurry. Liquid was gray in color and opaque. Collected 60 mL of liquid. No organic layer was observed.
		Drainable liquid	89.5	
206	15	Drainable liquid	250.6	Liquid was yellow in color and clear. Collected 290 mL of liquid. No organic layer was observed.
206	16	Drainable liquid	267.5	Liquid was yellow in color and clear. Collected 270 mL of liquid. No organic layer was observed.
206	17	Drainable liquid	270.5	Liquid was amber yellow in color and clear. Collected 290 mL of liquid. No organic layer was observed.

Table B2-2. Tank 241-AW-104 Subsampling Scheme and Sample Description. (2 sheets)

Core	Segment	Sample Portion	Weight (g)	Sample Characteristics
206	18	Upper half	73.1	Upper 3 in. of solids were burnt orange to medium brown in color and resembled a sludge slurry. Lower 5 in. were light to medium brown in color and resembled a wet sludge. Liquid was brown in color and opaque. Collected 190 mL of liquid. No organic layer was observed.
		Lower half	39.1	
		Drainable liquid	202.5	
206	19	Upper half	132.2	Solids were brown in color and resembled a sludge slurry. Liquid was brown in color and opaque. Collected 80 mL of liquid. No organic layer was observed.
		Lower half	105.7	
		Drainable liquid	102.3	
206	20	Lower half	201.3	Solids were gray-brown in color and resembled a sludge slurry. Liquid was brown in color and opaque. Collected 140 mL of liquid. No organic layer was observed.
		Drainable liquid	184.4	
206	21	Upper half	205.7	Solids were brown and white in color and resembled a sludge slurry. Liquid was brown in color and opaque. Collected 140 mL of liquid. No organic layer was observed.
		Lower half	107.2	
		Drainable liquid	40.1	
206	22	Upper half	295.9	Solids were brown in color and resembled a sludge slurry.
		Lower half	83.6	

B2.1.2 Sample Analysis

The analyses performed on the core samples were primarily those required by the safety screening DQO, including analyses for thermal properties by DSC, moisture content by TGA, content of fissile material by total alpha activity analysis, and bulk density (specific gravity on the liquid samples) by gravimetry. Total organic carbon analyses were performed on the samples that displayed exothermic behavior. Moisture content analyses by gravimetry were performed on the solids samples to corroborate the TGA results. A near-infrared spectroscopy analysis for moisture content was requested in the SAP to compare results with both the TGA and gravimetric percent water analyses. This request was later rescinded by the TWRS Technical Basis Group. (For fiscal year 1997, the infrared spectroscopy analysis was initially required for all tank samples. Schreiber [1997] limited that analysis to five single-shell tanks, thereby eliminating the analysis for tank 241-AW-104). Analyses for bromide (by IC) and lithium (by ICP) were performed to determine the extent of contamination by the hydrostatic head fluid and to correct the percent-water measurements. Although results for the other IC and ICP analytes were considered "opportunistic," the SAP required their reporting. Finally, the liquid samples were visually inspected for the presence of an organic layer.

All reported analyses were performed following approved laboratory procedures, as shown in Table B2-3. Table B2-4 summarizes the sample portions, sample numbers, and analyses performed on each sample.

Table B2-3. Analytical Procedures.

Analysis	Preparation Procedure	Analysis Procedure
DSC	Direct analysis	LA-514-114 Rev D-1
TGA	Direct analysis	LA-514-114 Rev D-1
Percent water (gravimetry)	Direct analysis	LA-564-101 Rev G-0
Total alpha activity	Liquid - direct analysis Solid - LA-549-101 Rev. F-0	LA-508-101 Rev G-0
TOC	Direct analysis	LA-342-100 Rev E-0
Metals by ICP	Liquid - direct analysis Solid - LA-505-159 Rev D-0 LA-549-141 Rev F-0	LA-505-151 Rev E-1 LA-505-161 Rev C-1 LA-505-161 Rev C-2
Anions by IC	Liquid - direct analysis Solid - LA-504-101 Rev F-0	LA-533-105 Rev D-1
Specific gravity	Direct analysis	LA-510-112 Rev D-1
Bulk density	Direct analysis	LO-160-103 Rev B-0
Combustible gas analyzer	Direct analysis	WHC-IP-0030 IH 1.4 and IH-2.1[1]

Notes:

[1]WHC (1992)

IH 1.4, "Industrial Hygiene Direct Reading Instrument Survey"

IH 2.1, "Standard Operating Procedure, MSA Model 260 Combustible Gas and Oxygen Analyzer"

Table B2-4. Tank 241-AW-104 Sample Analysis Summary.[1] (4 sheets)

Segment	Segment Portion	Sample Number	Analyses
Core 204, Riser 13A			
15	Drainable liquid	S97T001511	DSC, TGA, SpG, ICP, IC, total alpha
16	Drainable liquid	S97T001512	DSC, TGA, SpG, ICP, IC, total alpha
17	Drainable liquid	S97T001513	DSC, TGA, SpG, ICP, IC, total alpha
18	Drainable liquid	S97T001514	DSC, TGA, SpG, ICP, IC, total alpha
	Lower half	S97T001520	Bulk density
		S97T001521	DSC, TGA, percent water by gravimetry
		S97T001523	ICP, total alpha
		S97T001524	IC
19R	Drainable liquid	S97T001567	DSC, TGA, SpG, ICP, IC, total alpha
	Lower half	S97T001564	Bulk density
		S97T001566	Percent water by gravimetry
		S97T001570	ICP, total alpha
		S97T001571	IC
		S97T001997	DSC, TGA
20	Drainable liquid	S97T001587	DSC, TGA, SpG, ICP, IC, total alpha, TOC
21	Upper half	S97T001591	DSC, TGA, percent water by gravimetry
		S97T001597	ICP
		S97T001600	IC
	Lower half	S97T001585	Bulk density
		S97T001592	DSC, TGA, percent water by gravimetry
		S97T001598	ICP, total alpha
		S97T001601	IC

Table B2-4. Tank 241-AW-104 Sample Analysis Summary.[1] (4 sheets)

Segment	Segment Portion	Sample Number	Analyses
Core 204, Riser 13A (Cont'd)			
22	Drainable liquid	S97T001588	DSC, TGA, SpG, ICP, IC, total alpha, TOC
	Lower half	S97T001586	Bulk density
		S97T001593	DSC, TGA, percent water by gravimetry
		S97T001599	ICP, total alpha
		S97T001602	IC
Core 206, Riser 15A			
15	Drainable liquid	S97T001607	DSC, TGA, SpG, ICP, IC, total alpha
16	Drainable liquid	S97T001608	DSC, TGA, SpG, ICP, IC, total alpha
17	Drainable liquid	S97T001609	DSC, TGA, SpG, ICP, IC, total alpha
18	Drainable liquid	S97T001610	DSC, TGA, SpG, ICP, IC, total alpha
	Upper half	S97T001615	ICP
		S97T001617	DSC, TGA, percent water by gravimetry
		S97T001876	IC
	Lower half	S97T001616	ICP, total alpha
		S97T001618	DSC, TGA, percent water by gravimetry
		S97T001622	IC
		S97T001624	Bulk density
19	Drainable liquid	S97T001639	DSC, TGA, SpG, ICP, IC, total alpha
	Upper half	S97T001645	DSC, TGA, percent water by gravimetry
		S97T001659	ICP
		S97T001877	IC

Table B2-4. Tank 241-AW-104 Sample Analysis Summary.[1] (4 sheets)

Segment	Segment Portion	Sample Number	Analyses
19 (Cont'd)	Lower half	S97T001635	Bulk density
		S97T001648	DSC, TGA, percent water by gravimetry
		S97T001665	ICP, total alpha
		S97T001669	IC
20	Drainable liquid	S97T001640	DSC, TGA, SpG, ICP, IC, total alpha
	Lower half	S97T001636	Bulk density
		S97T001649	DSC, TGA, percent water by gravimetry
		S97T001666	ICP, total alpha
		S97T001670	IC
21	Drainable liquid	S97T001641	DSC, TGA, SpG, ICP, IC, total alpha, TOC
	Upper half	S97T001646	DSC, TGA, percent water by gravimetry, TOC
		S97T001660	ICP
		S97T001663	IC
	Lower half	S97T001637	Bulk density
		S97T001650	DSC, TGA, percent water by gravimetry
		S97T001667	ICP, total alpha
		S97T001671	IC
22	Upper half	S97T001647	DSC, TGA, percent water by gravimetry
		S97T001661	ICP
		S97T001664	IC
	Lower half	S97T001638	Bulk density
		S97T001651	DSC, TGA, percent water by gravimetry, TOC
		S97T001668	ICP, total alpha
		S97T001672	IC

Table B2-4. Tank 241-AW-104 Sample Analysis Summary.[1] (4 sheets)

Segment	Segment Portion	Sample Number	Analyses
Field blank		S97T001425	DSC, TGA, SpG, ICP, IC, total alpha
Hydrostatic head fluid		S97T001443	ICP, IC

Notes:

[1]Steen (1997)

B2.1.3 Discussion of Analytical Results

This section summarizes the sampling and analytical results associated with the June 1997 sampling and analysis of tank 241-AW-104. Table B2-5 shows the location of analytical results included in this report. These results are documented in Steen (1997).

Table B2-5. Analytical Tables.

Analysis	Table Number
Metals by iductively coupled plasma spectrometry	B2-9 to B2-44
Anions by ion chromatography	B2-45 to B2-52
Bulk density (solids)	B2-53
Specific gravity (liquids)	B2-58
Energetics by differential scanning calorimetry	B2-54 (dry weight) and B2-55 (wet weight)
Percent water by thermogravimetric analysis	B2-56
Percent water by gravimetry	B2-57
Total alpha	B2-59
Total inorganic carbon	B2-60
Total organic carbon by persulfate	B2-61

The quality control (QC) parameters assessed in conjunction with tank 241-AW-104 samples were standard recoveries, spike recoveries, duplicate analyses (measured by the relative percent difference [RPD] between the primary and duplicate subsamples), and blanks. The QC criteria are specified in the SAP (Benar 1997). The limits for blanks are set forth in guidelines followed by the laboratory, and all data results in this report have met those guidelines. Sample and duplicate pairs, in which any QC parameter was outside these limits, are footnoted in the sample mean column of the following data summary tables with an a, b, c, d, e, or f as follows:

- "a" indicates the standard recovery was below the QC limit
- "b" indicates the standard recovery was above the QC limit
- "c" indicates the spike recovery was below the QC limit
- "d" indicates the spike recovery was above the QC limit
- "e" indicates the RPD was above the QC limit
- "f" indicates blank contamination.

In the analytical tables in this section, the "mean" is the average of the result and duplicate value. All values, including those below the detection level (denoted by "<") were averaged. If both sample and duplicate values were non-detected or if one value was detected while the other was not, the mean is expressed as a non-detected value. If both values were detected, the mean is expressed as a detected value.

B2.1.3.1 Total Alpha Activity. Analyses for total alpha activity were performed on the samples recovered from tank 241-AW-104. Liquid samples were analyzed directly in duplicate. Solid samples were prepared by fusion digestion. Two fusions were prepared for each sample (for duplicate results). Each fused dilution was analyzed twice; the results were averaged and reported as one value. The highest result returned was 4.49 μCi/g.

B2.1.3.2 Thermogravimetric Analysis. Thermogravimetric analysis measures the mass of a sample as its temperature is increased at a constant rate. Nitrogen is passed over the sample during heating to remove any released gases. A decrease in the weight of a sample during TGA represents a loss of gaseous matter from the sample through evaporation or through a reaction that forms gas phase products. The moisture content is estimated by assuming that all TGA sample weight loss up to a certain temperature (typically 250 °C [482 °F]) is caused by water evaporation. The temperature limit for moisture loss is chosen by the operator at an inflection point on the TGA plot. Other volatile matter fractions can often be differentiated by inflection points as well.

The TGA analyses were performed in duplicate on direct samples. Approximately 17 percent of the thermograms showed weight loss beyond 250 °C. The percent-water measurements ranged from 25.1 to 75.0 percent for solid samples and 47.2 to 95.4 percent for liquid samples.

B2.1.3.3 Percent Water by Gravimetry. The gravimetric percent-water analyses were performed in duplicate on direct solid subsamples. The measurements were consistent with the TGA results for every subsample, ranging from 25.4 to 79.2.

B2.1.3.4 Differential Scanning Calorimetry. In a DSC analysis, heat absorbed or emitted by a substance is measured while the sample is heated at a constant rate. A nitrogen purge was applied to remove oxygen from the analytical system. The onset temperature for an endothermic or exothermic event is determined graphically.

The DSC analyses were performed in duplicate on direct subsamples. Exothermic results for a subsample were converted to a dry-weight basis using the average of the TGA results for that subsample. None of the samples submitted for the DSC analysis exceeded the notification limit of 480 J/g (dry-weight basis).

Two of the drainable liquid subsamples had differences in duplicates greater than the 20 percent precision threshold. Triplicate analyses were performed on these subsamples.

B2.1.3.5 Inductively Coupled Plasma Spectrometry. The liquid subsamples were prepared for analysis by an acid adjustment of the direct subsample. Solid subsamples were prepared for analysis by fusion.

The review of QC was limited to lithium. All other ICP results were considered "opportunistic" and did not have program-specified QC acceptance criteria. Therefore, any anomalies in those results were not discussed in this report. However, these "opportunistic" results were shown in the summary data tables with qualifier flags, which *assume* the same quality control limits as specified for lithium.

The primary metals observed were sodium, aluminum, uranium, and iron. Lithium concentrations were below detection levels in all samples. This indicates that hydrostatic head fluid contamination was not a problem.

B2.1.3.6 Ion Chromatography (Anions). The IC analyses were performed on direct subsamples of liquid samples. The solid subsamples were prepared for analysis by performing a water digest.

The QC review for this report was restricted to the required analyte, bromide. Results for the other anions are considered "opportunistic" and do not have program-defined QC parameters. The qualifier flags presented for the opportunistic analytical data in the summary tables *assume* that the QC limits would have been the same as for the required analytes.

The primary IC analytes were nitrate, nitrite, fluoride, and sulfate. Also detected were oxalate, chloride, and phosphate. All bromide results were below detection levels, indicating that hydrostatic head fluid contamination was not a problem.

B2.1.3.7 Specific Gravity and Bulk Density. Bulk density was performed on the solid subsamples, and results ranged from 1.20 g/mL to 1.69 g/mL. The 1.69 g/mL value was used to calculate the solid total alpha activity action limit for the tank. Specific gravity analyses were performed on the liquid subsamples. Results ranged between 1.00 and 1.49.

B2.1.3.8 Total Organic Carbon and Total Inorganic Carbon. Analyses for TOC and TIC were performed directly on both drainable liquid and solids subsamples using persulfate oxidation/coulometry. The TOC analysis was required as a secondary analysis for those samples exhibiting exothermic energy (five samples, including two solids and three drainable liquid samples). None of the results exceeded the TOC notification limit of 45,000 μg C/g. On a wet basis, the TOC means for the solids were 5,300 and 7,150 μg C/g, while those for the drainable liquid samples were 2,910, 3,920, and 4,510 μg C/mL. The QC requirements of the SAP apply to the TOC analysis.

Because the TIC analysis was considered "opportunistic," the SAP QC requirements were not applicable. TIC results were 6,010 and 13,000 μg C/g for the solids, and 3,030, 6,010, and 11,700 μg C/mL for the drainable liquid.

B2.2 VAPOR PHASE MEASUREMENT

Before the June 1997 core sampling of tank 241-AW-104, vapor phase measurements were taken in the tank's headspace. This measurement supported the hazardous vapor safety screening DQO (Dukelow et al. 1995). The vapor phase screening was taken to address flammability issues. The vapor phase measurements were taken 6.1 m (20 ft) below risers 13A and 15A in the dome space of the tank, and field results were used. No gas samples were sent to the laboratory for analysis. The results of the vapor phase measurements are provided in Table B2-6.

Table B2-6. Results of Headspace Vapor Measurements.

Measurement	Results
Total organic carbon	0 ppm
Lower flammability limit	0% of lower flammability limit
Oxygen	20.9%
Ammonia	5 ppm

B2.3 DESCRIPTION OF 1994 GRAB SAMPLING EVENT

On September 27, 1994, three grab samples were taken from riser 16C using the "bottle on a string" sampling method. Samples R6463 and R6464 were taken 1,040 cm (408 in.) and 427 cm (168 in.) above the tank bottom, respectively. The samples were described as a clear, light yellow liquid with an estimated solids content of <2 volume percent. Sample R6465 was obtained from 178 cm (70 in.) above the tank bottom, and was expected to contain sludge. However, no description, solids content, or radiation reading was recorded for R6465.

The samples were prepared for analysis in accordance with a letter of instruction (Bratzel 1994). A tank characterization plan was not generated specifically for these samples because the sampling of the tank was considered urgent (Bratzel 1994). The analyses were performed at the 222-S Laboratory in accordance with Bratzel (1994), and were based on requirements described in *Data Quality Objectives for the Waste Compatibility Program* (Carothers 1994). Samples R6463 and R6464 were analyzed for metals, anions, radionuclides, physical properties and carbon. Sample R6465 was analyzed only for anions and pH. Because of the lack of information regarding sample R6465, it is not known which waste phase was analyzed. Solids may not even have been recovered; no sample descriptions were provided to confirm their presence. The sample is referred to as the "sludge" sample in this TCR because it was expected to contain sludge.

The analytical results for the supernatant grab samples are presented in Table B2-7, while those for the sludge grab sample are shown in Table B2-8. The data for these samples were obtained from Rollison (1995). Note that the "Analyte" column contains information about the analytical method used to measure each analyte. Entries in this column contain the analytical method, which is listed first, followed by the analyte. All analytes were evaluated by direct analysis.

Table B2-7. Analytical Data for the September 1994 Supernatant Grab Samples. (3 sheets)

Analyte	Sample Number	Result	Mean	RSD (Mean)
Metal		μg/mL	μg/mL	%
ICP.Al	R6463	56.1	99.1	43
	R6464	142		
ICP.Fe	R6463	<1.05	<1.05	NA
	R6464	<1.05		
ICP.Na	R6463	6,550	8,280	21
	R6464	10,000		

Table B2-7. Analytical Data for the September 1994 Supernatant Grab Samples. (3 sheets)

Analyte	Sample Number	Result	Mean	RSD (Mean)
Anion		**μg/mL**	**μg/mL**	**%**
IC.Cl^-	R6463	31.5	59.3	47
	R6464	87.1		
IC.F^-	R6463	19.8	12.3	61
	R6464	4.82		
Pot.auto.OH^-	R6463	674	1,760	62
	R6464	2,850		
IC.NO_3^-	R6463	9,150	10,800	15
	R6464	12,400		
IC.NO_2^-	R6463	1,600	2,170	26
	R6464	2,740		
IC.PO_4^{3-}	R6463	<101	<101	NA
	R6464	<101		
IC.SO_4^{2-}	R6463	279	303	8
	R6464	326		
Radionuclide		**μCi/mL**	**μCi/mL**	**%**
Sep/APC.^{241}Am	R6463	<5.02 E-04	<4.72 E-04	NA
	R6464	<4.41 E-04		
GEA.^{134}Cs	R6463	0.00672	0.00876	---
	R6464	0.0108		
GEA.^{137}Cs	R6463	2.30	4.54	49
	R6464	6.78		
Sep/APC.$^{239/240}$Pu	R6463	1.59 E-05	1.63 E-05	2
	R6464	1.66 E-05		
Sep/BPC.^{90}Sr	R6463	0.00780	0.00779	0
	R6464	0.00777		

Table B2-7. Analytical Data for the September 1994 Supernatant Grab Samples. (3 sheets)

Analyte	Sample Number	Result	Mean	RSD (Mean)
Pysical Property				
TGA. %water	R6463	98.6%	97.9%	1
	R6464	97.2%		
Gravimetry% water	R6463	98.4%	97.8%	1
	R6464	97.2%		
[H$^+$].pH	R6463	12.19	12.44	2
	R6464	12.68		
SpG	R6463	0.979	0.988	1
	R6464	0.996		
Volume% solids	R6463	<2.00%	---	---
	R6464	<2.00%		
Weight% solids	R6463	2.40%	---	---
	R6464	3.80%		
DSC	R6463	No exotherms	---	---
	R6464	No exotherms		
Carbon		**μg C/mL**	**μg C/mL**	**%**
Coul.TIC	R6463	502	418	20
	R6464	334		
Coul.TOC	R6463	501	460	9
	R6464	418		

Notes:

Coul.	=	coulometry
GEA	=	gamma energy analysis
Pot.auto	=	potentiometric titration
Sep/APC	=	separation/alpha proportional counting
Sep/BPC	=	separation/beta proportional counting

Table B2-8. Analytical Data for the September 1994 Sludge Grab Sample.

Analyte	Sample Number	Result	Mean	RSD (mean)
Anion		μg/mL	μg/mL	%
IC.Cl^-	R6465	650	650	---
IC.F^-		294	294	---
Pot.auto.OH^-		8,860	8,860	--
IC.NO_3^-		23,900	23,900	---
IC.NO_2^-		11,900	11,900	---
IC.PO_4^{3-}		<101	<101	---
IC.SO_4^{2-}		792	792	---
Physical Property				
$[H^+]$.pH	R6465	13.00	13.00	---

B2.4 DESCRIPTION OF HISTORICAL SAMPLING EVENT

Historical records indicate that tank 241-AW-104 has been sampled six times. Sampling data are available for sampling events in 1986, 1984, 1983, 1982, and 1980 (2). Virtually all of the samples from 1986 and earlier were liquid, although solids were recovered during the two 1980 events. Because of the extensive transfer activity of tank 241-AW-104 and its involvement in several evaporator campaigns in the mid-1980's, the supernatant in the tank has changed significantly since the 1986 sampling event. Likewise, the amount of solids has increased and their composition has changed since the 1980 sampling events. Therefore, results from 1986 and earlier are not considered representative of the current tank contents and are not included in this TCR. The letters and reports containing the historical sampling results are referenced in Appendix E.

B2.5 1997 PUSH CORE DATA TABLES

Table B2-9. Tank 241-AW-104 Analytical Results: Aluminum (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			µg/g	µg/g	µg/g
S97T001523	204:18	Lower half	3,940	4,010	3,980
S97T001570	204:19R	Lower half	15,800	16,800	16,300
S97T001597	204:21	Upper half	19,000	19,500	19,300
S97T001598		Lower half	20,600	19,900	20,300
S97T001599	204:22	Lower half	19,600	19,900	19,800
S97T001615	206:18	Upper half	4,740	4,760	4,750
S97T001616		Lower half	6,750	7,180	6,970
S97T001659	206:19	Upper half	6,800	7,010	6,910
S97T001665		Lower half	25,600	24,700	25,200
S97T001666	206:20	Lower half	24,000	23,800	23,900
S97T001660	206:21	Upper half	17,700	17,900	17,800
S97T001667		Lower half	21,100	21,400	21,300
S97T001661	206:22	Upper half	16,600	16,700	16,700
S97T001668		Lower half	21,900	20,900	21,400
Liquids			µg/mL	µg/mL	µg/mL
S97T001511	204:15	Drainable liquid	308	303	306[QC:c]
S97T001512	204:16	Drainable liquid	760	731	746
S97T001513	204:17	Drainable liquid	1,850	1,830	1,840
S97T001514	204:18	Drainable liquid	3,340	3,280	3,310
S97T001567	204:19R	Drainable liquid	17,700	17,700	17,700
S97T001587	204:20	Drainable liquid	21,400	23,200	22,300[QC:d]
S97T001588	204:22	Drainable liquid	37,000	35,000	36,000[QC:c]
S97T001607	206:15	Drainable liquid	415	460	438[QC:d]
S97T001608	206:16	Drainable liquid	822	804	813
S97T001609	206:17	Drainable liquid	1,960	1,940	1,950[QC:c]
S97T001610	206:18	Drainable liquid	3,450	3,460	3,460
S97T001639	206:19	Drainable liquid	15,400	14,900	15,200
S97T001640	206:20	Drainable liquid	26,000	25,000	25,500
S97T001641	206:21	Drainable liquid	38,600	31,700	35,200

Table B2-10. Tank 241-AW-104 Analytical Results: Antimony (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			**μg/g**	**μg/g**	**μg/g**
S97T001523	204:18	Lower half	<1,360	<1,310	<1,340
S97T001570	204:19R	Lower half	<1,310	<1,300	<1,310
S97T001597	204:21	Upper half	<1,330	<1,340	<1,340
S97T001598		Lower half	<1,330	<1,330	<1,330
S97T001599	204:22	Lower half	<1,350	<1,330	<1,340
S97T001615	206:18	Upper half	<1,310	<1,340	<1,330
S97T001616		Lower half	<1,240	<1,250	<1,250
S97T001659	206:19	Upper half	<1,290	<1,300	<1,300
S97T001665		Lower half	<1,190	<1,190	<1,190
S97T001666	206:20	Lower half	<1,240	<1,220	<1,230
S97T001660	206:21	Upper half	<1,360	<1,310	<1,340
S97T001667		Lower half	1,900	<1,190	<1,550[QC:e]
S97T001661	206:22	Upper half	<1,360	<1,350	<1,360
S97T001668		Lower half	<1,200	1,300	<1,250
Liquids			**μg/mL**	**μg/mL**	**μg/mL**
S97T001511	204:15	Drainable liquid	<2.46	<2.46	<2.46
S97T001512	204:16	Drainable liquid	<3.06	<3.06	<3.06
S97T001513	204:17	Drainable liquid	<6.06	<6.06	<6.06
S97T001514	204:18	Drainable liquid	<12.1	<12.1	<12.1
S97T001567	204:19R	Drainable liquid	<36.1	<36.1	<36.1
S97T001587	204:20	Drainable liquid	<36.1	<36.1	<36.1
S97T001588	204:22	Drainable liquid	<36.1	<36.1	<36.1
S97T001607	206:15	Drainable liquid	<6	<6	<6
S97T001608	206:16	Drainable liquid	<6	<6	<6
S97T001609	206:17	Drainable liquid	<6	<6	<6
S97T001610	206:18	Drainable liquid	<6	<6	<6
S97T001639	206:19	Drainable liquid	<36.1	<36.1	<36.1
S97T001640	206:20	Drainable liquid	<36.1	<36.1	<36.1
S97T001641	206:21	Drainable liquid	<36.1	<36.1	<36.1

Table B2-11. Tank 241-AW-104 Analytical Results: Arsenic (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			µg/g	µg/g	µg/g
S97T001523	204:18	Lower half	<2,270	<2,180	<2,230
S97T001570	204:19R	Lower half	<2,180	<2,170	<2,180
S97T001597	204:21	Upper half	<2,210	<2,230	<2,220
S97T001598		Lower half	<2,210	<2,210	<2,210
S97T001599	204:22	Lower half	<2,240	<2,220	<2,230
S97T001615	206:18	Upper half	<2,180	<2,240	<2,210
S97T001616		Lower half	<2,070	<2,080	<2,080
S97T001659	206:19	Upper half	<2,160	<2,170	<2,170
S97T001665		Lower half	<1,980	<1,990	<1,990
S97T001666	206:20	Lower half	<2,060	<2,040	<2,050
S97T001660	206:21	Upper half	<2,260	<2,180	<2,220
S97T001667		Lower half	<1,980	<1,990	<1,990
S97T001661	206:22	Upper half	<2,270	<2,250	<2,260
S97T001668		Lower half	<1,990	<2,000	<2,000
Liquids			µg/mL	µg/mL	µg/mL
S97T001511	204:15	Drainable liquid	<4.1	<4.1	<4.1
S97T001512	204:16	Drainable liquid	<5.1	<5.1	<5.1
S97T001513	204:17	Drainable liquid	<10.1	<10.1	<10.1
S97T001514	204:18	Drainable liquid	<20.1	<20.1	<20.1
S97T001567	204:19R	Drainable liquid	<60.1	<60.1	<60.1
S97T001587	204:20	Drainable liquid	<60.1	<60.1	<60.1
S97T001588	204:22	Drainable liquid	<60.1	<60.1	<60.1
S97T001607	206:15	Drainable liquid	<10	<10	<10
S97T001608	206:16	Drainable liquid	<10	<10	<10
S97T001609	206:17	Drainable liquid	<10	<10	<10
S97T001610	206:18	Drainable liquid	<10	<10	<10
S97T001639	206:19	Drainable liquid	<60.1	<60.1	<60.1
S97T001640	206:20	Drainable liquid	<60.1	<60.1	<60.1
S97T001641	206:21	Drainable liquid	<60.1	<60.1	<60.1

Table B2-12. Tank 241-AW-104 Analytical Results: Barium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			µg/g	µg/g	µg/g
S97T001523	204:18	Lower half	<1,130	<1,090	<1,110
S97T001570	204:19R	Lower half	<1,090	<1,080	<1,090
S97T001597	204:21	Upper half	<1,110	<1,110	<1,110
S97T001598		Lower half	<1,110	<1,110	<1,110
S97T001599	204:22	Lower half	<1,120	<1,110	<1,120
S97T001615	206:18	Upper half	<1,090	<1,120	<1,110
S97T001616		Lower half	<1,030	<1,040	<1,040
S97T001659	206:19	Upper half	<1,080	<1,080	<1,080
S97T001665		Lower half	<988	<994	<991
S97T001666	206:20	Lower half	<1,030	<1,020	<1,030
S97T001660	206:21	Upper half	<1,130	<1,090	<1,110
S97T001667		Lower half	<990	<993	<992
S97T001661	206:22	Upper half	<1,140	<1,120	<1,130
S97T001668		Lower half	<997	<1,000	<999
Liquids			µg/mL	µg/mL	µg/mL
S97T001511	204:15	Drainable liquid	<2.05	<2.05	<2.05
S97T001512	204:16	Drainable liquid	<2.55	<2.55	<2.55
S97T001513	204:17	Drainable liquid	<5.05	<5.05	<5.05
S97T001514	204:18	Drainable liquid	<10.1	<10.1	<10.1
S97T001567	204:19R	Drainable liquid	<30.1	<30.1	<30.1
S97T001587	204:20	Drainable liquid	<30.1	<30.1	<30.1
S97T001588	204:22	Drainable liquid	<30.1	<30.1	<30.1
S97T001607	206:15	Drainable liquid	<5	<5	<5
S97T001608	206:16	Drainable liquid	<5	<5	<5
S97T001609	206:17	Drainable liquid	<5	<5	<5
S97T001610	206:18	Drainable liquid	<5	<5	<5
S97T001639	206:19	Drainable liquid	<30.1	<30.1	<30.1
S97T001640	206:20	Drainable liquid	<30.1	<30.1	<30.1
S97T001641	206:21	Drainable liquid	<30.1	<30.1	<30.1

Table B2-13. Tank 241-AW-104 Analytical Results: Beryllium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			µg/g	µg/g	µg/g
S97T001523	204:18	Lower half	<113	<109	<111
S97T001570	204:19R	Lower half	<109	<108	<109
S97T001597	204:21	Upper half	<111	<111	<111
S97T001598		Lower half	<111	<111	<111
S97T001599	204:22	Lower half	<112	<111	<112
S97T001615	206:18	Upper half	<109	<112	<111
S97T001616		Lower half	<103	<104	<104
S97T001659	206:19	Upper half	<108	<108	<108
S97T001665		Lower half	<98.8	<99.4	<99.1
S97T001666	206:20	Lower half	<103	<102	<103
S97T001660	206:21	Upper half	<113	<109	<111
S97T001667		Lower half	<99	<99.3	<99.2
S97T001661	206:22	Upper half	<114	<112	<113
S97T001668		Lower half	<99.7	<100	<99.8
Liquids			µg/mL	µg/mL	µg/mL
S97T001511	204:15	Drainable liquid	<0.205	<0.205	<0.205
S97T001512	204:16	Drainable liquid	<0.255	<0.255	<0.255
S97T001513	204:17	Drainable liquid	<0.505	<0.505	<0.505
S97T001514	204:18	Drainable liquid	<1.01	<1.01	<1.01
S97T001567	204:19R	Drainable liquid	<3	<3	<3
S97T001587	204:20	Drainable liquid	<3	<3	<3
S97T001588	204:22	Drainable liquid	<3	<3	<3
S97T001607	206:15	Drainable liquid	<0.5	<0.5	<0.5
S97T001608	206:16	Drainable liquid	<0.5	<0.5	<0.5
S97T001609	206:17	Drainable liquid	<0.5	<0.5	<0.5
S97T001610	206:18	Drainable liquid	<0.5	<0.5	<0.5
S97T001639	206:19	Drainable liquid	<3	<3	<3
S97T001640	206:20	Drainable liquid	<3	<3	<3
S97T001641	206:21	Drainable liquid	<3	<3	<3

Table B2-14. Tank 241-AW-104 Analytical Results: Bismuth (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			**μg/g**	**μg/g**	**μg/g**
S97T001523	204:18	Lower half	<2,270	<2,180	<2,230
S97T001570	204:19R	Lower half	<2,180	<2,170	<2,180
S97T001597	204:21	Upper half	<2,210	<2,230	<2,220
S97T001598		Lower half	<2,210	<2,210	<2,210
S97T001599	204:22	Lower half	<2,240	<2,220	<2,230
S97T001615	206:18	Upper half	<2,180	<2,240	<2,210
S97T001616		Lower half	<2,070	<2,080	<2,080
S97T001659	206:19	Upper half	<2,160	<2,170	<2,170
S97T001665		Lower half	<1,980	<1,990	<1,990
S97T001666	206:20	Lower half	<2,060	<2,040	<2,050
S97T001660	206:21	Upper half	<2,260	<2,180	<2,220
S97T001667		Lower half	<1,980	<1,990	<1,990
S97T001661	206:22	Upper half	<2,270	<2,250	<2,260
S97T001668		Lower half	<1,990	<2,000	<2,000
Liquids			**μg/mL**	**μg/mL**	**μg/mL**
S97T001511	204:15	Drainable liquid	<4.1	<4.1	<4.1
S97T001512	204:16	Drainable liquid	<5.1	<5.1	<5.1
S97T001513	204:17	Drainable liquid	<10.1	<10.1	<10.1
S97T001514	204:18	Drainable liquid	<20.1	<20.1	<20.1
S97T001567	204:19R	Drainable liquid	<60.1	<60.1	<60.1
S97T001587	204:20	Drainable liquid	<60.1	<60.1	<60.1
S97T001588	204:22	Drainable liquid	<60.1	<60.1	<60.1
S97T001607	206:15	Drainable liquid	<10	<10	<10
S97T001608	206:16	Drainable liquid	<10	<10	<10
S97T001609	206:17	Drainable liquid	<10	<10	<10
S97T001610	206:18	Drainable liquid	<10	<10	<10
S97T001639	206:19	Drainable liquid	<60.1	<60.1	<60.1
S97T001640	206:20	Drainable liquid	<60.1	<60.1	<60.1
S97T001641	206:21	Drainable liquid	<60.1	<60.1	<60.1

Table B2-15. Tank 241-AW-104 Analytical Results: Boron (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			μg/g	μg/g	μg/g
S97T001523	204:18	Lower half	<1,130	<1,090	<1,110
S97T001570	204:19R	Lower half	<1,090	<1,080	<1,090
S97T001597	204:21	Upper half	<1,110	<1,110	<1,110
S97T001598		Lower half	<1,110	<1,110	<1,110
S97T001599	204:22	Lower half	<1,120	<1,110	<1,120
S97T001615	206:18	Upper half	<1,090	<1,120	<1,110
S97T001616		Lower half	<1,030	<1,040	<1,040
S97T001659	206:19	Upper half	<1,080	<1,080	<1,080
S97T001665		Lower half	<988	<994	<991
S97T001666	206:20	Lower half	<1,030	<1,020	<1,030
S97T001660	206:21	Upper half	<1,130	<1,090	<1,110
S97T001667		Lower half	<990	<993	<992
S97T001661	206:22	Upper half	<1,140	<1,120	<1,130
S97T001668		Lower half	<997	<1,000	<999
Liquids			μg/mL	μg/mL	μg/mL
S97T001511	204:15	Drainable liquid	2.45	2.2	2.33
S97T001512	204:16	Drainable liquid	3.44	3.13	3.29
S97T001513	204:17	Drainable liquid	5.42	<5.05	<5.23
S97T001514	204:18	Drainable liquid	<10.1	<10.1	<10.1
S97T001567	204:19R	Drainable liquid	33.2	33.5	33.4
S97T001587	204:20	Drainable liquid	40.2	42.6	41.4
S97T001588	204:22	Drainable liquid	52.2	53.7	53
S97T001607	206:15	Drainable liquid	<5	<5	<5
S97T001608	206:16	Drainable liquid	<5	<5	<5
S97T001609	206:17	Drainable liquid	5.86	5.42	5.64
S97T001610	206:18	Drainable liquid	8.52	8.52	8.52
S97T001639	206:19	Drainable liquid	32.8	32.5	32.6
S97T001640	206:20	Drainable liquid	41.1	39.3	40.2
S97T001641	206:21	Drainable liquid	59.3	44.7	52[QC:c]

Table B2-16. Tank 241-AW-104 Analytical Results: Cadmium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			µg/g	µg/g	µg/g
S97T001523	204:18	Lower half	<113	<109	<111
S97T001570	204:19R	Lower half	<109	<108	<109
S97T001597	204:21	Upper half	<111	<111	<111
S97T001598		Lower half	<111	<111	<111
S97T001599	204:22	Lower half	<112	<111	<112
S97T001615	206:18	Upper half	<109	121	<115
S97T001616		Lower half	185	182	184
S97T001659	206:19	Upper half	<108	114	<111
S97T001665		Lower half	<98.8	111	<105
S97T001666	206:20	Lower half	<103	<102	<103
S97T001660	206:21	Upper half	<113	<109	<111
S97T001667		Lower half	<99	<99.3	<99.2
S97T001661	206:22	Upper half	<114	<112	<113
S97T001668		Lower half	<99.7	<100	<99.8
Liquids			µg/mL	µg/mL	µg/mL
S97T001511	204:15	Drainable liquid	<0.205	<0.205	<0.205
S97T001512	204:16	Drainable liquid	0.294	<0.255	<0.274
S97T001513	204:17	Drainable liquid	<0.505	<0.505	<0.505
S97T001514	204:18	Drainable liquid	2.02	2.17	2.09
S97T001567	204:19R	Drainable liquid	<3	<3	<3
S97T001587	204:20	Drainable liquid	<3	<3	<3
S97T001588	204:22	Drainable liquid	<3	<3	<3
S97T001607	206:15	Drainable liquid	<0.5	<0.5	<0.5
S97T001608	206:16	Drainable liquid	<0.5	<0.5	<0.5
S97T001609	206:17	Drainable liquid	0.892	0.857	0.875
S97T001610	206:18	Drainable liquid	1.79	1.87	1.83
S97T001639	206:19	Drainable liquid	<3	<3	<3
S97T001640	206:20	Drainable liquid	<3	<3	<3
S97T001641	206:21	Drainable liquid	<3	<3	<3

Table B2-17. Tank 241-AW-104 Analytical Results: Calcium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			**μg/g**	**μg/g**	**μg/g**
S97T001523	204:18	Lower half	2,720	2,430	2,580
S97T001570	204:19R	Lower half	5,410	5,310	5,360
S97T001597	204:21	Upper half	<2,210	<2,230	<2,220
S97T001598		Lower half	<2,210	<2,210	<2,210
S97T001599	204:22	Lower half	<2,240	<2,220	<2,230
S97T001615	206:18	Upper half	2,800	2,900	2,850
S97T001616		Lower half	2,260	2,310	2,290
S97T001659	206:19	Upper half	4,970	5,080	5,030
S97T001665		Lower half	4,470	4,500	4,490
S97T001666	206:20	Lower half	<2,060	<2,040	<2,050
S97T001660	206:21	Upper half	<2,260	<2,180	<2,220
S97T001667		Lower half	<1,980	<1,990	<1,990
S97T001661	206:22	Upper half	<2,270	<2,250	<2,260
S97T001668		Lower half	<1,990	<2,000	<2,000
Liquids			**μg/mL**	**μg/mL**	**μg/mL**
S97T001511	204:15	Drainable liquid	<4.1	<4.1	<4.1
S97T001512	204:16	Drainable liquid	<5.1	<5.1	<5.1
S97T001513	204:17	Drainable liquid	<10.1	<10.1	<10.1
S97T001514	204:18	Drainable liquid	<20.1	<20.1	<20.1
S97T001567	204:19R	Drainable liquid	<60.1	<60.1	<60.1
S97T001587	204:20	Drainable liquid	<60.1	<60.1	<60.1
S97T001588	204:22	Drainable liquid	<60.1	<60.1	<60.1
S97T001607	206:15	Drainable liquid	<10	<10	<10
S97T001608	206:16	Drainable liquid	<10	<10	<10
S97T001609	206:17	Drainable liquid	<10	<10	<10
S97T001610	206:18	Drainable liquid	<10	<10	<10
S97T001639	206:19	Drainable liquid	<60.1	<60.1	<60.1
S97T001640	206:20	Drainable liquid	<60.1	<60.1	<60.1
S97T001641	206:21	Drainable liquid	<60.1	<60.1	<60.1

Table B2-18. Tank 241-AW-104 Analytical Results: Cerium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S97T001523	204:18	Lower half	<2,270	<2,180	<2,230
S97T001570	204:19R	Lower half	<2,180	<2,170	<2,180
S97T001597	204:21	Upper half	<2,210	<2,230	<2,220
S97T001598		Lower half	<2,210	<2,210	<2,210
S97T001599	204:22	Lower half	<2,240	<2,220	<2,230
S97T001615	206:18	Upper half	<2,180	<2,240	<2,210
S97T001616		Lower half	<2,070	<2,080	<2,080
S97T001659	206:19	Upper half	<2,160	<2,170	<2,170
S97T001665		Lower half	<1,980	<1,990	<1,990
S97T001666	206:20	Lower half	<2,060	<2,040	<2,050
S97T001660	206:21	Upper half	<2,260	<2,180	<2,220
S97T001667		Lower half	<1,980	<1,990	<1,990
S97T001661	206:22	Upper half	<2,270	<2,250	<2,260
S97T001668		Lower half	<1,990	<2,000	<2,000
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S97T001511	204:15	Drainable liquid	<4.1	<4.1	<4.1
S97T001512	204:16	Drainable liquid	<5.1	<5.1	<5.1
S97T001513	204:17	Drainable liquid	<10.1	<10.1	<10.1
S97T001514	204:18	Drainable liquid	<20.1	<20.1	<20.1
S97T001567	204:19R	Drainable liquid	<60.1	<60.1	<60.1
S97T001587	204:20	Drainable liquid	<60.1	<60.1	<60.1
S97T001588	204:22	Drainable liquid	<60.1	<60.1	<60.1
S97T001607	206:15	Drainable liquid	<10	<10	<10
S97T001608	206:16	Drainable liquid	<10	<10	<10
S97T001609	206:17	Drainable liquid	<10	<10	<10
S97T001610	206:18	Drainable liquid	<10	<10	<10
S97T001639	206:19	Drainable liquid	<60.1	<60.1	<60.1
S97T001640	206:20	Drainable liquid	<60.1	<60.1	<60.1
S97T001641	206:21	Drainable liquid	<60.1	<60.1	<60.1

Table B2-19. Tank 241-AW-104 Analytical Results: Chromium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			**μg/g**	**μg/g**	**μg/g**
S97T001523	204:18	Lower half	<227	<218	<223
S97T001570	204:19R	Lower half	710	671	691
S97T001597	204:21	Upper half	5,260	5,200	5,230
S97T001598		Lower half	1,280	1,160	1,220
S97T001599	204:22	Lower half	312	313	313
S97T001615	206:18	Upper half	<218	<224	<221
S97T001616		Lower half	302	339	321
S97T001659	206:19	Upper half	248	269	259
S97T001665		Lower half	2,270	2,130	2,200
S97T001666	206:20	Lower half	3,870	3,090	3,480[QC:e]
S97T001660	206:21	Upper half	1,600	1,450	1,530
S97T001667		Lower half	2,750	2,670	2,710
S97T001661	206:22	Upper half	3,660	3,500	3,580
S97T001668		Lower half	7,870	7,780	7,830
Liquids			**μg/mL**	**μg/mL**	**μg/mL**
S97T001511	204:15	Drainable liquid	2.45	2.43	2.44
S97T001512	204:16	Drainable liquid	2.35	2.24	2.29
S97T001513	204:17	Drainable liquid	1.9	2.19	2.04
S97T001514	204:18	Drainable liquid	2.82	2.82	2.82
S97T001567	204:19R	Drainable liquid	54.5	54.9	54.7
S97T001587	204:20	Drainable liquid	76.7	83.4	80.1
S97T001588	204:22	Drainable liquid	32.8	31.9	32.3
S97T001607	206:15	Drainable liquid	2.35	2.66	2.5
S97T001608	206:16	Drainable liquid	2.47	2.5	2.49
S97T001609	206:17	Drainable liquid	2.16	1.95	2.06
S97T001610	206:18	Drainable liquid	2.7	2.84	2.77
S97T001639	206:19	Drainable liquid	68	66	67
S97T001640	206:20	Drainable liquid	109	104	107
S97T001641	206:21	Drainable liquid	90.1	74.3	82.2

Table B2-20. Tank 241-AW-104 Analytical Results: Cobalt (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			µg/g	µg/g	µg/g
S97T001523	204:18	Lower half	<454	<437	<446
S97T001570	204:19R	Lower half	<436	<434	<435
S97T001597	204:21	Upper half	<443	<446	<445
S97T001598		Lower half	<443	<442	<443
S97T001599	204:22	Lower half	<448	<444	<446
S97T001615	206:18	Upper half	<437	<448	<443
S97T001616		Lower half	<413	<416	<415
S97T001659	206:19	Upper half	<431	<434	<433
S97T001665		Lower half	<395	<398	<397
S97T001666	206:20	Lower half	<412	<408	<410
S97T001660	206:21	Upper half	<453	<437	<445
S97T001667		Lower half	<396	<397	<397
S97T001661	206:22	Upper half	<454	<449	<452
S97T001668		Lower half	<399	<400	<400
Liquids			µg/mL	µg/mL	µg/mL
S97T001511	204:15	Drainable liquid	<0.82	<0.82	<0.82
S97T001512	204:16	Drainable liquid	<1.02	<1.02	<1.02
S97T001513	204:17	Drainable liquid	<2.02	<2.02	<2.02
S97T001514	204:18	Drainable liquid	<4.02	<4.02	<4.02
S97T001567	204:19R	Drainable liquid	<12	<12	<12
S97T001587	204:20	Drainable liquid	<12	<12	<12
S97T001588	204:22	Drainable liquid	<12	<12	<12
S97T001607	206:15	Drainable liquid	<2	<2	<2
S97T001608	206:16	Drainable liquid	<2	<2	<2
S97T001609	206:17	Drainable liquid	<2	<2	<2
S97T001610	206:18	Drainable liquid	<2	<2	<2
S97T001639	206:19	Drainable liquid	<12	<12	<12
S97T001640	206:20	Drainable liquid	<12	<12	<12
S97T001641	206:21	Drainable liquid	<12	<12	<12

Table B2-21. Tank 241-AW-104 Analytical Results: Copper (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S97T001523	204:18	Lower half	<227	<218	<223
S97T001570	204:19R	Lower half	<218	<217	<218
S97T001597	204:21	Upper half	<221	<223	<222
S97T001598		Lower half	<221	<221	<221
S97T001599	204:22	Lower half	<224	<222	<223
S97T001615	206:18	Upper half	<218	<224	<221
S97T001616		Lower half	<207	<208	<208
S97T001659	206:19	Upper half	<216	<217	<217
S97T001665		Lower half	<198	<199	<199
S97T001666	206:20	Lower half	<206	<204	<205
S97T001660	206:21	Upper half	<226	<218	<222
S97T001667		Lower half	<198	<199	<199
S97T001661	206:22	Upper half	<227	<225	<226
S97T001668		Lower half	<199	<200	<200
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S97T001511	204:15	Drainable liquid	<0.41	<0.41	<0.41
S97T001512	204:16	Drainable liquid	<0.51	<0.51	<0.51
S97T001513	204:17	Drainable liquid	<1.01	<1.01	<1.01
S97T001514	204:18	Drainable liquid	<2.01	2.38	<2.19
S97T001567	204:19R	Drainable liquid	<6.01	<6.01	<6.01
S97T001587	204:20	Drainable liquid	<6.01	<6.01	<6.01
S97T001588	204:22	Drainable liquid	<6.01	<6.01	<6.01
S97T001607	206:15	Drainable liquid	<1	<1	<1
S97T001608	206:16	Drainable liquid	<1	<1	<1
S97T001609	206:17	Drainable liquid	<1	<1	<1
S97T001610	206:18	Drainable liquid	<1	1.01	<1
S97T001639	206:19	Drainable liquid	<6.01	<6.01	<6.01
S97T001640	206:20	Drainable liquid	<6.01	<6.01	<6.01
S97T001641	206:21	Drainable liquid	<6.01	<6.01	<6.01

Table B2-22. Tank 241-AW-104 Analytical Results: Iron (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			µg/g	µg/g	µg/g
S97T001523	204:18	Lower half	8,380	7,740	8,060
S97T001570	204:19R	Lower half	12,100	12,500	12,300
S97T001597	204:21	Upper half	3,050	3,340	3,200
S97T001598		Lower half	1,140	<1,110	<1,130
S97T001599	204:22	Lower half	<1,120	<1,110	<1,120
S97T001615	206:18	Upper half	5,830	5,900	5,870
S97T001616		Lower half	9,470	10,200	9,840
S97T001659	206:19	Upper half	10,700	13,800	12,300[QC:e]
S97T001665		Lower half	8,810	8,480	8,650
S97T001666	206:20	Lower half	<1,030	<1,020	<1,030
S97T001660	206:21	Upper half	2,670	2,500	2,590
S97T001667		Lower half	<990	<993	<992
S97T001661	206:22	Upper half	1,270	1,170	1,220
S97T001668		Lower half	<997	<1,000	<999
Liquids			µg/mL	µg/mL	µg/mL
S97T001511	204:15	Drainable liquid	<2.05	<2.05	<2.05
S97T001512	204:16	Drainable liquid	<2.55	<2.55	<2.55
S97T001513	204:17	Drainable liquid	<5.05	<5.05	<5.05
S97T001514	204:18	Drainable liquid	<10.1	<10.1	<10.1
S97T001567	204:19R	Drainable liquid	<30.1	<30.1	<30.1
S97T001587	204:20	Drainable liquid	<30.1	<30.1	<30.1
S97T001588	204:22	Drainable liquid	<30.1	<30.1	<30.1
S97T001607	206:15	Drainable liquid	<5	<5	<5
S97T001608	206:16	Drainable liquid	<5	<5	<5
S97T001609	206:17	Drainable liquid	<5	<5	<5
S97T001610	206:18	Drainable liquid	<5	<5	<5
S97T001639	206:19	Drainable liquid	<30.1	<30.1	<30.1
S97T001640	206:20	Drainable liquid	<30.1	<30.1	<30.1
S97T001641	206:21	Drainable liquid	<30.1	<30.1	<30.1

Table B2-23. Tank 241-AW-104 Analytical Results: Lanthanum (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			μg/g	μg/g	μg/g
S97T001523	204:18	Lower half	<1,130	<1,090	<1,110
S97T001570	204:19R	Lower half	<1,090	<1,080	<1,090
S97T001597	204:21	Upper half	<1,110	<1,110	<1,110
S97T001598		Lower half	<1,110	<1,110	<1,110
S97T001599	204:22	Lower half	<1,120	<1,110	<1,120
S97T001615	206:18	Upper half	<1,090	<1,120	<1,110
S97T001616		Lower half	<1,030	<1,040	<1,040
S97T001659	206:19	Upper half	<1,080	<1,080	<1,080
S97T001665		Lower half	<988	<994	<991
S97T001666	206:20	Lower half	<1,030	<1,020	<1,030
S97T001660	206:21	Upper half	<1,130	<1,090	<1,110
S97T001667		Lower half	<990	<993	<992
S97T001661	206:22	Upper half	<1,140	<1,120	<1,130
S97T001668		Lower half	<997	<1,000	<999
Liquids			μg/mL	μg/mL	μg/mL
S97T001511	204:15	Drainable liquid	<2.05	<2.05	<2.05
S97T001512	204:16	Drainable liquid	<2.55	<2.55	<2.55
S97T001513	204:17	Drainable liquid	<5.05	<5.05	<5.05
S97T001514	204:18	Drainable liquid	<10.1	<10.1	<10.1
S97T001567	204:19R	Drainable liquid	<30.1	<30.1	<30.1
S97T001587	204:20	Drainable liquid	<30.1	<30.1	<30.1
S97T001588	204:22	Drainable liquid	<30.1	<30.1	<30.1
S97T001607	206:15	Drainable liquid	<5	<5	<5
S97T001608	206:16	Drainable liquid	<5	<5	<5
S97T001609	206:17	Drainable liquid	<5	<5	<5
S97T001610	206:18	Drainable liquid	<5	<5	<5
S97T001639	206:19	Drainable liquid	<30.1	<30.1	<30.1
S97T001640	206:20	Drainable liquid	<30.1	<30.1	<30.1
S97T001641	206:21	Drainable liquid	<30.1	<30.1	<30.1

Table B2-24. Tank 241-AW-104 Analytical Results: Lead (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			µg/g	µg/g	µg/g
S97T001523	204:18	Lower half	<2,270	<2,180	<2,230
S97T001570	204:19R	Lower half	<2,180	<2,170	<2,180
S97T001597	204:21	Upper half	<2,210	<2,230	<2,220
S97T001598		Lower half	<2,210	<2,210	<2,210
S97T001599	204:22	Lower half	<2,240	<2,220	<2,230
S97T001615	206:18	Upper half	<2,180	<2,240	<2,210
S97T001616		Lower half	<2,070	<2,080	<2,080
S97T001659	206:19	Upper half	<2,160	<2,170	<2,170
S97T001665		Lower half	<1,980	<1,990	<1,990
S97T001666	206:20	Lower half	<2,060	<2,040	<2,050
S97T001660	206:21	Upper half	<2,260	<2,180	<2,220
S97T001667		Lower half	<1,980	<1,990	<1,990
S97T001661	206:22	Upper half	<2,270	<2,250	<2,260
S97T001668		Lower half	<1,990	<2,000	<2,000
Liquids			µg/mL	µg/mL	µg/mL
S97T001511	204:15	Drainable liquid	<4.1	<4.1	<4.1
S97T001512	204:16	Drainable liquid	<5.1	<5.1	<5.1
S97T001513	204:17	Drainable liquid	<10.1	<10.1	<10.1
S97T001514	204:18	Drainable liquid	<20.1	<20.1	<20.1
S97T001567	204:19R	Drainable liquid	<60.1	<60.1	<60.1
S97T001587	204:20	Drainable liquid	<60.1	<60.1	<60.1
S97T001588	204:22	Drainable liquid	<60.1	<60.1	<60.1
S97T001607	206:15	Drainable liquid	<10	<10	<10
S97T001608	206:16	Drainable liquid	<10	<10	<10
S97T001609	206:17	Drainable liquid	<10	<10	<10
S97T001610	206:18	Drainable liquid	<10	<10	<10
S97T001639	206:19	Drainable liquid	<60.1	<60.1	<60.1
S97T001640	206:20	Drainable liquid	<60.1	<60.1	<60.1
S97T001641	206:21	Drainable liquid	<60.1	<60.1	<60.1

Table B2-25. Tank 241-AW-104 Analytical Results: Lithium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			µg/g	µg/g	µg/g
S97T001523	204:18	Lower half	<227	<218	<223
S97T001570	204:19R	Lower half	<218	<217	<218
S97T001597	204:21	Upper half	<221	<223	<222
S97T001598		Lower half	<221	<221	<221
S97T001599	204:22	Lower half	<224	<222	<223
S97T001615	206:18	Upper half	<218	<224	<221
S97T001616		Lower half	<207	<208	<208
S97T001659	206:19	Upper half	<216	<217	<217
S97T001665		Lower half	<198	<199	<199
S97T001666	206:20	Lower half	<206	<204	<205
S97T001660	206:21	Upper half	<226	<218	<222
S97T001667		Lower half	<198	<199	<199
S97T001661	206:22	Upper half	<227	<225	<226
S97T001668		Lower half	<199	<200	<200
Liquids			µg/mL	µg/mL	µg/mL
S97T001511	204:15	Drainable liquid	<0.41	<0.41	<0.41
S97T001512	204:16	Drainable liquid	<0.51	<0.51	<0.51
S97T001513	204:17	Drainable liquid	<1.01	<1.01	<1.01
S97T001514	204:18	Drainable liquid	<2.01	<2.01	<2.01
S97T001567	204:19R	Drainable liquid	<6.01	<6.01	<6.01
S97T001587	204:20	Drainable liquid	<6.01	<6.01	<6.01
S97T001588	204:22	Drainable liquid	<6.01	<6.01	<6.01
S97T001607	206:15	Drainable liquid	<1	<1	<1
S97T001608	206:16	Drainable liquid	<1	<1	<1
S97T001609	206:17	Drainable liquid	<1	<1	<1
S97T001610	206:18	Drainable liquid	<1	<1	<1
S97T001639	206:19	Drainable liquid	<6.01	<6.01	<6.01
S97T001640	206:20	Drainable liquid	<6.01	<6.01	<6.01
S97T001641	206:21	Drainable liquid	<6.01	<6.01	<6.01

Table B2-26. Tank 241-AW-104 Analytical Results: Magnesium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			µg/g	µg/g	µg/g
S97T001523	204:18	Lower half	<2,270	<2,180	<2,230
S97T001570	204:19R	Lower half	<2,180	<2,170	<2,180
S97T001597	204:21	Upper half	<2,210	<2,230	<2,220
S97T001598		Lower half	<2,210	<2,210	<2,210
S97T001599	204:22	Lower half	<2,240	<2,220	<2,230
S97T001615	206:18	Upper half	<2,180	<2,240	<2,210
S97T001616		Lower half	<2,070	<2,080	<2,080
S97T001659	206:19	Upper half	<2,160	<2,170	<2,170
S97T001665		Lower half	<1,980	<1,990	<1,990
S97T001666	206:20	Lower half	<2,060	<2,040	<2,050
S97T001660	206:21	Upper half	<2,260	<2,180	<2,220
S97T001667		Lower half	<1,980	<1,990	<1,990
S97T001661	206:22	Upper half	<2,270	<2,250	<2,260
S97T001668		Lower half	<1,990	<2,000	<2,000
Liquids			µg/mL	µg/mL	µg/mL
S97T001511	204:15	Drainable liquid	<4.1	<4.1	<4.1
S97T001512	204:16	Drainable liquid	<5.1	<5.1	<5.1
S97T001513	204:17	Drainable liquid	<10.1	<10.1	<10.1
S97T001514	204:18	Drainable liquid	<20.1	<20.1	<20.1
S97T001567	204:19R	Drainable liquid	<60.1	<60.1	<60.1
S97T001587	204:20	Drainable liquid	<60.1	<60.1	<60.1
S97T001588	204:22	Drainable liquid	<60.1	<60.1	<60.1
S97T001607	206:15	Drainable liquid	<10	<10	<10
S97T001608	206:16	Drainable liquid	<10	<10	<10
S97T001609	206:17	Drainable liquid	<10	<10	<10
S97T001610	206:18	Drainable liquid	<10	<10	<10
S97T001639	206:19	Drainable liquid	<60.1	<60.1	<60.1
S97T001640	206:20	Drainable liquid	<60.1	<60.1	<60.1
S97T001641	206:21	Drainable liquid	<60.1	<60.1	<60.1

Table B2-27. Tank 241-AW-104 Analytical Results: Manganese (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			μg/g	μg/g	μg/g
S97T001523	204:18	Lower half	3,130	3,100	3,120
S97T001570	204:19R	Lower half	2,780	2,770	2,780
S97T001597	204:21	Upper half	1,290	1,350	1,320
S97T001598		Lower half	389	393	391
S97T001599	204:22	Lower half	<224	<222	<223
S97T001615	206:18	Upper half	2,310	2,370	2,340
S97T001616		Lower half	7,740	8,280	8,010
S97T001659	206:19	Upper half	1,600	1,660	1,630
S97T001665		Lower half	1,750	1,740	1,750
S97T001666	206:20	Lower half	215	<204	<210
S97T001660	206:21	Upper half	726	654	690
S97T001667		Lower half	293	278	286
S97T001661	206:22	Upper half	441	372	407
S97T001668		Lower half	<199	<200	<200
Liquids			μg/mL	μg/mL	μg/mL
S97T001511	204:15	Drainable liquid	<0.41	<0.41	<0.41
S97T001512	204:16	Drainable liquid	<0.51	<0.51	<0.51
S97T001513	204:17	Drainable liquid	<1.01	<1.01	<1.01
S97T001514	204:18	Drainable liquid	2.57	4.65	3.61[QC:c]
S97T001567	204:19R	Drainable liquid	6.49	<6.01	<6.25
S97T001587	204:20	Drainable liquid	<6.01	<6.01	<6.01
S97T001588	204:22	Drainable liquid	<6.01	<6.01	<6.01
S97T001607	206:15	Drainable liquid	<1	<1	<1
S97T001608	206:16	Drainable liquid	<1	<1	<1
S97T001609	206:17	Drainable liquid	<1	<1	<1
S97T001610	206:18	Drainable liquid	<1	<1	<1
S97T001639	206:19	Drainable liquid	10.3	11.2	10.8
S97T001640	206:20	Drainable liquid	7.17	<6.01	<6.59
S97T001641	206:21	Drainable liquid	<6.01	<6.01	<6.01

Table B2-28. Tank 241-AW-104 Analytical Results: Molybdenum (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			µg/g	µg/g	µg/g
S97T001523	204:18	Lower half	<1,130	<1,090	<1,110
S97T001570	204:19R	Lower half	<1,090	<1,080	<1,090
S97T001597	204:21	Upper half	<1,110	<1,110	<1,110
S97T001598		Lower half	<1,110	<1,110	<1,110
S97T001599	204:22	Lower half	<1,120	<1,110	<1,120
S97T001615	206:18	Upper half	<1,090	<1,120	<1,110
S97T001616		Lower half	<1,030	<1,040	<1,040
S97T001659	206:19	Upper half	<1,080	<1,080	<1,080
S97T001665		Lower half	<988	<994	<991
S97T001666	206:20	Lower half	<1,030	<1,020	<1,030
S97T001660	206:21	Upper half	<1,130	<1,090	<1,110
S97T001667		Lower half	<990	<993	<992
S97T001661	206:22	Upper half	<1,140	<1,120	<1,130
S97T001668		Lower half	<997	<1,000	<999
Liquids			µg/mL	µg/mL	µg/mL
S97T001511	204:15	Drainable liquid	<2.05	<2.05	<2.05
S97T001512	204:16	Drainable liquid	<2.55	<2.55	<2.55
S97T001513	204:17	Drainable liquid	5.95	6.37	6.16
S97T001514	204:18	Drainable liquid	13.1	12.8	12.9
S97T001567	204:19R	Drainable liquid	45.8	49.1	47.5
S97T001587	204:20	Drainable liquid	54.7	58.9	56.8
S97T001588	204:22	Drainable liquid	76	75.8	75.9
S97T001607	206:15	Drainable liquid	<5	<5	<5
S97T001608	206:16	Drainable liquid	<5	<5	<5
S97T001609	206:17	Drainable liquid	6.86	6.6	6.73
S97T001610	206:18	Drainable liquid	13.2	12.8	13
S97T001639	206:19	Drainable liquid	47.7	44.3	46
S97T001640	206:20	Drainable liquid	58	56.5	57.3
S97T001641	206:21	Drainable liquid	80	66.2	73.1

Table B2-29. Tank 241-AW-104 Analytical Results: Neodymium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			μg/g	μg/g	μg/g
S97T001523	204:18	Lower half	<2,270	<2,180	<2,230
S97T001570	204:19R	Lower half	<2,180	<2,170	<2,180
S97T001597	204:21	Upper half	<2,210	<2,230	<2,220
S97T001598		Lower half	<2,210	<2,210	<2,210
S97T001599	204:22	Lower half	<2,240	<2,220	<2,230
S97T001615	206:18	Upper half	<2,180	<2,240	<2,210
S97T001616		Lower half	<2,070	<2,080	<2,080
S97T001659	206:19	Upper half	<2,160	<2,170	<2,170
S97T001665		Lower half	<1,980	<1,990	<1,990
S97T001666	206:20	Lower half	<2,060	<2,040	<2,050
S97T001660	206:21	Upper half	<2,260	<2,180	<2,220
S97T001667		Lower half	<1,980	<1,990	<1,990
S97T001661	206:22	Upper half	<2,270	<2,250	<2,260
S97T001668		Lower half	<1,990	<2,000	<2,000
Liquids			μg/mL	μg/mL	μg/mL
S97T001511	204:15	Drainable liquid	<4.1	<4.1	<4.1
S97T001512	204:16	Drainable liquid	<5.1	<5.1	<5.1
S97T001513	204:17	Drainable liquid	<10.1	<10.1	<10.1
S97T001514	204:18	Drainable liquid	<20.1	<20.1	<20.1
S97T001567	204:19R	Drainable liquid	<60.1	<60.1	<60.1
S97T001587	204:20	Drainable liquid	<60.1	<60.1	<60.1
S97T001588	204:22	Drainable liquid	<60.1	<60.1	<60.1
S97T001607	206:15	Drainable liquid	<10	<10	<10
S97T001608	206:16	Drainable liquid	<10	<10	<10
S97T001609	206:17	Drainable liquid	<10	<10	<10
S97T001610	206:18	Drainable liquid	<10	<10	<10
S97T001639	206:19	Drainable liquid	<60.1	<60.1	<60.1
S97T001640	206:20	Drainable liquid	<60.1	<60.1	<60.1
S97T001641	206:21	Drainable liquid	<60.1	<60.1	<60.1

Table B2-30. Tank 241-AW-104 Analytical Results: Nickel (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Liquids			μg/mL	μg/mL	μg/mL
S97T001511	204:15	Drainable liquid	<0.82	<0.82	<0.82
S97T001512	204:16	Drainable liquid	<1.02	<1.02	<1.02
S97T001513	204:17	Drainable liquid	<2.02	<2.02	<2.02
S97T001514	204:18	Drainable liquid	<4.02	<4.02	<4.02
S97T001567	204:19R	Drainable liquid	<12	<12	<12
S97T001587	204:20	Drainable liquid	<12	<12	<12
S97T001588	204:22	Drainable liquid	<12	<12	<12
S97T001607	206:15	Drainable liquid	<2	<2	<2
S97T001608	206:16	Drainable liquid	<2	<2	<2
S97T001609	206:17	Drainable liquid	<2	2.05	<2.02
S97T001610	206:18	Drainable liquid	<2	2.75	<2.38[QC:e]
S97T001639	206:19	Drainable liquid	<12	<12	<12
S97T001640	206:20	Drainable liquid	<12	<12	<12
S97T001641	206:21	Drainable liquid	<12	<12	<12

Table B2-31. Tank 241-AW-104 Analytical Results: Phosphorus (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			µg/g	µg/g	µg/g
S97T001523	204:18	Lower half	<4,540	<4,370	<4,460
S97T001570	204:19R	Lower half	<4,360	<4,340	<4,350
S97T001597	204:21	Upper half	<4,430	<4,460	<4,450
S97T001598		Lower half	<4,430	<4,420	<4,430
S97T001599	204:22	Lower half	<4,480	<4,440	<4,460
S97T001615	206:18	Upper half	<4,370	<4,480	<4,430
S97T001616		Lower half	<4,130	<4,160	<4,150
S97T001659	206:19	Upper half	<4,310	<4,340	<4,330
S97T001665		Lower half	<3,950	<3,980	<3,970
S97T001666	206:20	Lower half	<4,120	<4,080	<4,100
S97T001660	206:21	Upper half	<4,530	<4,370	<4,450
S97T001667		Lower half	<3,960	<3,970	<3,970
S97T001661	206:22	Upper half	5,710	7,200	6,460[QC:e]
S97T001668		Lower half	<3,990	<4,000	<4,000
Liquids			µg/mL	µg/mL	µg/mL
S97T001511	204:15	Drainable liquid	88.6	87.6	88.1
S97T001512	204:16	Drainable liquid	127	120	124
S97T001513	204:17	Drainable liquid	212	208	210
S97T001514	204:18	Drainable liquid	335	330	333
S97T001567	204:19R	Drainable liquid	519	498	509
S97T001587	204:20	Drainable liquid	470	506	488
S97T001588	204:22	Drainable liquid	473	466	470
S97T001607	206:15	Drainable liquid	79.5	90.3	84.9
S97T001608	206:16	Drainable liquid	132	130	131
S97T001609	206:17	Drainable liquid	217	219	218
S97T001610	206:18	Drainable liquid	313	313	313
S97T001639	206:19	Drainable liquid	572	553	563
S97T001640	206:20	Drainable liquid	417	392	405
S97T001641	206:21	Drainable liquid	923	673	798[QC:e]

Table B2-32. Tank 241-AW-104 Analytical Results: Potassium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Liquids			µg/mL	µg/mL	µg/mL
S97T001511	204:15	Drainable liquid	1,750	1,710	1,730[QC:c]
S97T001512	204:16	Drainable liquid	2,090	2,010	2,050
S97T001513	204:17	Drainable liquid	2,730	2,690	2,710
S97T001514	204:18	Drainable liquid	3,520	3,450	3,490[QC:c]
S97T001567	204:19R	Drainable liquid	10,600	10,600	10,600
S97T001587	204:20	Drainable liquid	12,500	13,600	13,100[QC:d]
S97T001588	204:22	Drainable liquid	18,200	17,700	18,000[QC:c]
S97T001607	206:15	Drainable liquid	1,620	1,790	1,710[QC:d]
S97T001608	206:16	Drainable liquid	2,130	2,060	2,100
S97T001609	206:17	Drainable liquid	2,700	2,640	2670[QC:c]
S97T001610	206:18	Drainable liquid	3,320	3,340	3,330
S97T001639	206:19	Drainable liquid	8,180	7,960	8,070
S97T001640	206:20	Drainable liquid	12,900	12,400	12,700
S97T001641	206:21	Drainable liquid	17,800	14,900	16,400

Table B2-33. Tank 241-AW-104 Analytical Results: Samarium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			μg/g	μg/g	μg/g
S97T001523	204:18	Lower half	<2,270	<2,180	<2,230
S97T001570	204:19R	Lower half	<2,180	<2,170	<2,180
S97T001597	204:21	Upper half	<2,210	<2,230	<2,220
S97T001598		Lower half	<2,210	<2,210	<2,210
S97T001599	204:22	Lower half	<2,240	<2,220	<2,230
S97T001615	206:18	Upper half	<2,180	<2,240	<2,210
S97T001616		Lower half	<2,070	<2,080	<2,080
S97T001659	206:19	Upper half	<2,160	<2,170	<2,170
S97T001665		Lower half	<1,980	<1,990	<1,990
S97T001666	206:20	Lower half	<2,060	<2,040	<2,050
S97T001660	206:21	Upper half	<2,260	<2,180	<2,220
S97T001667		Lower half	<1,980	<1,990	<1,990
S97T001661	206:22	Upper half	<2,270	<2,250	<2,260
S97T001668		Lower half	<1,990	<2,000	<2,000
Liquids			μg/mL	μg/mL	μg/mL
S97T001511	204:15	Drainable liquid	<4.1	<4.1	<4.1
S97T001512	204:16	Drainable liquid	<5.1	<5.1	<5.1
S97T001513	204:17	Drainable liquid	<10.1	<10.1	<10.1
S97T001514	204:18	Drainable liquid	<20.1	<20.1	<20.1
S97T001567	204:19R	Drainable liquid	<60.1	<60.1	<60.1
S97T001587	204:20	Drainable liquid	<60.1	<60.1	<60.1
S97T001588	204:22	Drainable liquid	<60.1	<60.1	<60.1
S97T001607	206:15	Drainable liquid	<10	<10	<10
S97T001608	206:16	Drainable liquid	<10	<10	<10
S97T001609	206:17	Drainable liquid	<10	<10	<10
S97T001610	206:18	Drainable liquid	<10	<10	<10
S97T001639	206:19	Drainable liquid	<60.1	<60.1	<60.1
S97T001640	206:20	Drainable liquid	<60.1	<60.1	<60.1
S97T001641	206:21	Drainable liquid	<60.1	<60.1	<60.1

Table B2-34. Tank 241-AW-104 Analytical Results: Silicon (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			μg/g	μg/g	μg/g
S97T001523	204:18	Lower half	<1,130	<1,090	<1,110
S97T001570	204:19R	Lower half	1,930	5,900	3,920[QC:e]
S97T001597	204:21	Upper half	2,050	1,640	1,850[QC:e]
S97T001598		Lower half	1,250	1,420	1,340
S97T001599	204:22	Lower half	<1,120	<1,110	<1120
S97T001615	206:18	Upper half	<1,090	<1,120	<1110
S97T001616		Lower half	1,350	1,650	1,500
S97T001659	206:19	Upper half	2,040	2,340	2,190
S97T001665		Lower half	1,930	1,950	1,940
S97T001666	206:20	Lower half	<1,030	<1,020	<1,030
S97T001660	206:21	Upper half	<1,130	<1,090	<1,110
S97T001667		Lower half	<990	<993	<992
S97T001661	206:22	Upper half	1,190	1,160	1,180
S97T001668		Lower half	1,460	1,710	1,590
Liquids			μg/mL	μg/mL	μg/mL
S97T001511	204:15	Drainable liquid	56	55.9	56[QC:d]
S97T001512	204:16	Drainable liquid	64.8	63.4	64.1
S97T001513	204:17	Drainable liquid	105	96.7	101
S97T001514	204:18	Drainable liquid	58.3	90.8	74.5[QC:e]
S97T001567	204:19R	Drainable liquid	101	101	101
S97T001587	204:20	Drainable liquid	209	208	209
S97T001588	204:22	Drainable liquid	162	150	156
S97T001607	206:15	Drainable liquid	58.8	65.6	62.2[QC:d]
S97T001608	206:16	Drainable liquid	63	62.2	62.6
S97T001609	206:17	Drainable liquid	76.1	74.8	75.4[QC:d]
S97T001610	206:18	Drainable liquid	59.6	58.7	59.2
S97T001639	206:19	Drainable liquid	109	100	105
S97T001640	206:20	Drainable liquid	115	93.1	104[QC:e]
S97T001641	206:21	Drainable liquid	199	152	176[QC:e]

Table B2-35. Tank 241-AW-104 Analytical Results: Silver (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S97T001523	204:18	Lower half	<227	<218	<223
S97T001570	204:19R	Lower half	<218	<217	<218
S97T001597	204:21	Upper half	<221	<223	<222
S97T001598		Lower half	<221	<221	<221
S97T001599	204:22	Lower half	<224	<222	<223
S97T001615	206:18	Upper half	<218	<224	<221
S97T001616		Lower half	<207	<208	<208
S97T001659	206:19	Upper half	<216	<217	<217
S97T001665		Lower half	<198	<199	<199
S97T001666	206:20	Lower half	<206	<204	<205
S97T001660	206:21	Upper half	<226	<218	<222
S97T001667		Lower half	<198	<199	<199
S97T001661	206:22	Upper half	<227	<225	<226
S97T001668		Lower half	<199	<200	<200
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S97T001511	204:15	Drainable liquid	0.938	1.01	0.974
S97T001512	204:16	Drainable liquid	1.59	1.48	1.54
S97T001513	204:17	Drainable liquid	2.67	2.69	2.68
S97T001514	204:18	Drainable liquid	4.38	4.25	4.31[QC:c]
S97T001567	204:19R	Drainable liquid	11.7	11.2	11.4
S97T001587	204:20	Drainable liquid	13	13.5	13.3
S97T001588	204:22	Drainable liquid	15.5	14.9	15.2
S97T001607	206:15	Drainable liquid	1.01	1.11	1.06
S97T001608	206:16	Drainable liquid	1.6	1.49	1.54
S97T001609	206:17	Drainable liquid	2.78	2.71	2.75
S97T001610	206:18	Drainable liquid	4.32	4.21	4.27
S97T001639	206:19	Drainable liquid	11.8	11.7	11.8
S97T001640	206:20	Drainable liquid	13.2	12.9	13.1
S97T001641	206:21	Drainable liquid	18.7	14.6	16.6[QC:c]

Table B2-36. Tank 241-AW-104 Analytical Results: Sodium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			μg/g	μg/g	μg/g
S97T001523	204:18	Lower half	63,700	63,600	63,700
S97T001570	204:19R	Lower half	95,800	95,900	95,900
S97T001597	204:21	Upper half	229,000	228,000	229,000
S97T001598		Lower half	169,000	160,000	165,000
S97T001599	204:22	Lower half	175,000	173,000	174,000
S97T001615	206:18	Upper half	67,100	67,500	67,300
S97T001616		Lower half	92,900	96,000	94,500
S97T001659	206:19	Upper half	89,400	91,300	90,400
S97T001665		Lower half	163,000	167,000	165,000
S97T001666	206:20	Lower half	254,000	238,000	246,000
S97T001660	206:21	Upper half	192,000	186,000	189,000
S97T001667		Lower half	249,000	241,000	245,000
S97T001661	206:22	Upper half	227,000	228,000	228,000
S97T001668		Lower half	335,000	323,000	3.29E+05[QC:d]
Liquids			μg/mL	μg/mL	μg/mL
S97T001511	204:15	Drainable liquid	13,600	13,300	13,500[QC:c]
S97T001512	204:16	Drainable liquid	21,000	20,200	20,600
S97T001513	204:17	Drainable liquid	36,000	35,700	35,900
S97T001514	204:18	Drainable liquid	58,300	57,100	57,700[QC:d]
S97T001567	204:19R	Drainable liquid	1.68E+05	1.69E+05	1.69E+05
S97T001587	204:20	Drainable liquid	1.85E+05	2.01E+05	1.93E+05[QC:d]
S97T001588	204:22	Drainable liquid	2.17E+05	2.12E+05	2.15E+05[QC:c]
S97T001607	206:15	Drainable liquid	13,300	14,700	14,000[QC:d]
S97T001608	206:16	Drainable liquid	21,700	21,100	21,400
S97T001609	206:17	Drainable liquid	37,000	36,500	36,800[QC:c]
S97T001610	206:18	Drainable liquid	57,000	57,200	57,100
S97T001639	206:19	Drainable liquid	1.56E+05	1.50E+05	1.53E+05
S97T001640	206:20	Drainable liquid	1.86E+05	1.79E+05	1.83E+05[QC:d]
S97T001641	206:21	Drainable liquid	2.39E+05	1.98E+05	2.19E+05

Table B2-37. Tank 241-AW-104 Analytical Results: Strontium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S97T001523	204:18	Lower half	<227	<218	<223
S97T001570	204:19R	Lower half	<218	<217	<218
S97T001597	204:21	Upper half	<221	<223	<222
S97T001598		Lower half	<221	<221	<221
S97T001599	204:22	Lower half	<224	<222	<223
S97T001615	206:18	Upper half	<218	<224	<221
S97T001616		Lower half	<207	<208	<208
S97T001659	206:19	Upper half	<216	<217	<217
S97T001665		Lower half	<198	<199	<199
S97T001666	206:20	Lower half	<206	<204	<205
S97T001660	206:21	Upper half	<226	<218	<222
S97T001667		Lower half	<198	<199	<199
S97T001661	206:22	Upper half	<227	<225	<226
S97T001668		Lower half	<199	<200	<200
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S97T001511	204:15	Drainable liquid	<0.41	<0.41	<0.41
S97T001512	204:16	Drainable liquid	<0.51	<0.51	<0.51
S97T001513	204:17	Drainable liquid	<1.01	<1.01	<1.01
S97T001514	204:18	Drainable liquid	<2.01	<2.01	<2.01
S97T001567	204:19R	Drainable liquid	<6.01	<6.01	<6.01
S97T001587	204:20	Drainable liquid	<6.01	<6.01	<6.01
S97T001588	204:22	Drainable liquid	<6.01	<6.01	<6.01
S97T001607	206:15	Drainable liquid	<1	<1	<1
S97T001608	206:16	Drainable liquid	<1	<1	<1
S97T001609	206:17	Drainable liquid	<1	<1	<1
S97T001610	206:18	Drainable liquid	<1	<1	<1
S97T001639	206:19	Drainable liquid	<6.01	<6.01	<6.01
S97T001640	206:20	Drainable liquid	<6.01	<6.01	<6.01
S97T001641	206:21	Drainable liquid	<6.01	<6.01	<6.01

Table B2-38. Tank 241-AW-104 Analytical Results: Sulfur (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			μg/g	μg/g	μg/g
S97T001523	204:18	Lower half	<2,270	<2,180	<2,230
S97T001570	204:19R	Lower half	<2,180	<2,170	<2,180
S97T001597	204:21	Upper half	10,000	9,990	10,000
S97T001598		Lower half	5,700	6,340	6,020
S97T001599	204:22	Lower half	3,110	3,080	3,100
S97T001615	206:18	Upper half	<2,180	<2,240	<2,210
S97T001616		Lower half	<2,070	<2,080	<2,080
S97T001659	206:19	Upper half	<2,160	<2,170	<2,170
S97T001665		Lower half	3,060	3,290	3,180
S97T001666	206:20	Lower half	8,290	6,740	7520[QC:e]
S97T001660	206:21	Upper half	12,400	11,200	11,800
S97T001667		Lower half	11,300	10,800	11,100
S97T001661	206:22	Upper half	9,990	9,250	9,620
S97T001668		Lower half	6,860	6,470	6,670
Liquids			μg/mL	μg/mL	μg/mL
S97T001511	204:15	Drainable liquid	163	164	164
S97T001512	204:16	Drainable liquid	191	184	188
S97T001513	204:17	Drainable liquid	288	289	289
S97T001514	204:18	Drainable liquid	489	480	485
S97T001567	204:19R	Drainable liquid	941	936	939
S97T001587	204:20	Drainable liquid	921	981	951
S97T001588	204:22	Drainable liquid	566	420	493[QC:e]
S97T001607	206:15	Drainable liquid	152	169	161
S97T001608	206:16	Drainable liquid	190	190	190
S97T001609	206:17	Drainable liquid	289	289	289
S97T001610	206:18	Drainable liquid	440	442	441
S97T001639	206:19	Drainable liquid	1,180	1,140	1,160
S97T001640	206:20	Drainable liquid	807	774	791
S97T001641	206:21	Drainable liquid	823	670	747[QC:e]

Table B2-39. Tank 241-AW-104 Analytical Results: Thallium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			μg/g	μg/g	μg/g
S97T001523	204:18	Lower half	<4,540	<4,370	<4,460
S97T001570	204:19R	Lower half	<4,360	<4,340	<4,350
S97T001597	204:21	Upper half	<4,430	<4,460	<4,450
S97T001598		Lower half	<4,430	<4,420	<4,430
S97T001599	204:22	Lower half	<4,480	<4,440	<4,460
S97T001615	206:18	Upper half	<4,370	<4,480	<4,430
S97T001616		Lower half	<4,130	<4,160	<4,150
S97T001659	206:19	Upper half	<4,310	<4,340	<4,330
S97T001665		Lower half	<3,950	<3,980	<3,970
S97T001666	206:20	Lower half	<4,120	<4,080	<4,100
S97T001660	206:21	Upper half	<4,530	<4,370	<4,450
S97T001667		Lower half	<3,960	<3,970	<3,970
S97T001661	206:22	Upper half	<4,540	<4,490	<4,520
S97T001668		Lower half	<3,990	<4,000	<4,000
Liquids			μg/mL	μg/mL	μg/mL
S97T001511	204:15	Drainable liquid	<8.2	<8.2	<8.2
S97T001512	204:16	Drainable liquid	<10.2	<10.2	<10.2
S97T001513	204:17	Drainable liquid	<20.2	<20.2	<20.2
S97T001514	204:18	Drainable liquid	<40.2	<40.2	<40.2
S97T001567	204:19R	Drainable liquid	<120	<120	<120
S97T001587	204:20	Drainable liquid	<120	<120	<120
S97T001588	204:22	Drainable liquid	<120	<120	<120
S97T001607	206:15	Drainable liquid	<20	<20	<20
S97T001608	206:16	Drainable liquid	<20	<20	<20
S97T001609	206:17	Drainable liquid	<20	<20	<20
S97T001610	206:18	Drainable liquid	<20	<20	<20
S97T001639	206:19	Drainable liquid	<120	<120	<120
S97T001640	206:20	Drainable liquid	<120	<120	<120
S97T001641	206:21	Drainable liquid	<120	<120	<120

Table B2-40. Tank 241-AW-104 Analytical Results: Titanium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			μg/g	μg/g	μg/g
S97T001523	204:18	Lower half	<227	<218	<223
S97T001570	204:19R	Lower half	<218	<217	<218
S97T001597	204:21	Upper half	<221	<223	<222
S97T001598		Lower half	<221	<221	<221
S97T001599	204:22	Lower half	<224	<222	<223
S97T001615	206:18	Upper half	<218	<224	<221
S97T001616		Lower half	<207	<208	<208
S97T001659	206:19	Upper half	<216	<217	<217
S97T001665		Lower half	<198	<199	<199
S97T001666	206:20	Lower half	<206	<204	<205
S97T001660	206:21	Upper half	<226	<218	<222
S97T001667		Lower half	<198	<199	<199
S97T001661	206:22	Upper half	<227	<225	<226
S97T001668		Lower half	<199	<200	<200
Liquids			μg/mL	μg/mL	μg/mL
S97T001511	204:15	Drainable liquid	<0.41	<0.41	<0.41
S97T001512	204:16	Drainable liquid	<0.51	<0.51	<0.51
S97T001513	204:17	Drainable liquid	<1.01	<1.01	<1.01
S97T001514	204:18	Drainable liquid	<2.01	<2.01	<2.01
S97T001567	204:19R	Drainable liquid	<6.01	<6.01	<6.01
S97T001587	204:20	Drainable liquid	<6.01	<6.01	<6.01
S97T001588	204:22	Drainable liquid	<6.01	<6.01	<6.01
S97T001607	206:15	Drainable liquid	<1	<1	<1
S97T001608	206:16	Drainable liquid	<1	<1	<1
S97T001609	206:17	Drainable liquid	<1	<1	<1
S97T001610	206:18	Drainable liquid	<1	<1	<1
S97T001639	206:19	Drainable liquid	<6.01	<6.01	<6.01
S97T001640	206:20	Drainable liquid	<6.01	<6.01	<6.01
S97T001641	206:21	Drainable liquid	<6.01	<6.01	<6.01

Table B2-41. Tank 241-AW-104 Analytical Results: Total Uranium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			μg/g	μg/g	μg/g
S97T001523	204:18	Lower half	25,100	25,200	25,200
S97T001570	204:19R	Lower half	30,800	30,100	30,500
S97T001597	204:21	Upper half	<11,100	<11,100	<11,100
S97T001598		Lower half	<11,100	<11,100	<11,100
S97T001599	204:22	Lower half	<11,200	<11,100	<11,200
S97T001615	206:18	Upper half	33,300	33,900	33,600
S97T001616		Lower half	27,900	31,900	29,900
S97T001659	206:19	Upper half	27,900	28,900	28,400
S97T001665		Lower half	23,800	25,800	24,800
S97T001666	206:20	Lower half	<10,300	<10,200	<10,300
S97T001660	206:21	Upper half	<11,300	<10,900	<11,100
S97T001667		Lower half	<9,900	<9,930	<9,920
S97T001661	206:22	Upper half	<11,400	<11,200	<11,300
S97T001668		Lower half	<9,970	<10,000	<9,990
Liquids			μg/mL	μg/mL	μg/mL
S97T001511	204:15	Drainable liquid	<20.5	<20.5	<20.5
S97T001512	204:16	Drainable liquid	<25.5	<25.5	<25.5
S97T001513	204:17	Drainable liquid	<50.5	<50.5	<50.5
S97T001514	204:18	Drainable liquid	<100	<100	<100
S97T001567	204:19R	Drainable liquid	<300	<300	<300
S97T001587	204:20	Drainable liquid	<300	<300	<300
S97T001588	204:22	Drainable liquid	<300	<300	<300
S97T001607	206:15	Drainable liquid	<50	<50	<50
S97T001608	206:16	Drainable liquid	<50	<50	<50
S97T001609	206:17	Drainable liquid	<50	<50	<50
S97T001610	206:18	Drainable liquid	<50	<50	<50
S97T001639	206:19	Drainable liquid	<300	<300	<300
S97T001640	206:20	Drainable liquid	<300	<300	<300
S97T001641	206:21	Drainable liquid	<300	<300	<300

Table B2-42. Tank 241-AW-104 Analytical Results: Vanadium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			**μg/g**	**μg/g**	**μg/g**
S97T001523	204:18	Lower half	<1,130	<1,090	<1,110
S97T001570	204:19R	Lower half	<1,090	<1,080	<1,090
S97T001597	204:21	Upper half	<1,110	<1,110	<1,110
S97T001598		Lower half	<1,110	<1,110	<1,110
S97T001599	204:22	Lower half	<1,120	<1,110	<1,120
S97T001615	206:18	Upper half	<1,090	<1,120	<1,110
S97T001616		Lower half	<1,030	<1,040	<1,040
S97T001659	206:19	Upper half	<1,080	<1,080	<1,080
S97T001665		Lower half	<988	<994	<991
S97T001666	206:20	Lower half	<1,030	<1,020	<1,030
S97T001660	206:21	Upper half	<1,130	<1,090	<1,110
S97T001667		Lower half	<990	<993	<992
S97T001661	206:22	Upper half	<1,140	<1,120	<1,130
S97T001668		Lower half	<997	<1,000	<999
Liquids			**μg/mL**	**μg/mL**	**μg/mL**
S97T001511	204:15	Drainable liquid	<2.05	<2.05	<2.05
S97T001512	204:16	Drainable liquid	<2.55	<2.55	<2.55
S97T001513	204:17	Drainable liquid	<5.05	<5.05	<5.05
S97T001514	204:18	Drainable liquid	<10.1	<10.1	<10.1
S97T001567	204:19R	Drainable liquid	<30.1	<30.1	<30.1
S97T001587	204:20	Drainable liquid	<30.1	<30.1	<30.1
S97T001588	204:22	Drainable liquid	<30.1	<30.1	<30.1
S97T001607	206:15	Drainable liquid	<5	<5	<5
S97T001608	206:16	Drainable liquid	<5	<5	<5
S97T001609	206:17	Drainable liquid	<5	<5	<5
S97T001610	206:18	Drainable liquid	<5	<5	<5
S97T001639	206:19	Drainable liquid	<30.1	<30.1	<30.1
S97T001640	206:20	Drainable liquid	<30.1	<30.1	<30.1
S97T001641	206:21	Drainable liquid	<30.1	<30.1	<30.1

Table B2-43. Tank 241-AW-104 Analytical Results: Zinc (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			µg/g	µg/g	µg/g
S97T001523	204:18	Lower half	<227	<218	<223
S97T001570	204:19R	Lower half	553	577	565
S97T001597	204:21	Upper half	<221	<223	<222
S97T001598		Lower half	<221	<221	<221
S97T001599	204:22	Lower half	<224	<222	<223
S97T001615	206:18	Upper half	<218	<224	<221
S97T001616		Lower half	<207	<208	<208
S97T001659	206:19	Upper half	<216	<217	<217
S97T001665		Lower half	<198	<199	<199
S97T001666	206:20	Lower half	<206	<204	<205
S97T001660	206:21	Upper half	<226	<218	<222
S97T001667		Lower half	943	638	791[QC:e]
S97T001661	206:22	Upper half	<227	<225	<226
S97T001668		Lower half	281	394	338[QC:e]
Liquids			µg/mL	µg/mL	µg/mL
S97T001511	204:15	Drainable liquid	3.58	3.58	3.58
S97T001512	204:16	Drainable liquid	3.31	3.19	3.25
S97T001513	204:17	Drainable liquid	5.66	5.66	5.66
S97T001514	204:18	Drainable liquid	2.77	3.7	3.24[QC:c]
S97T001567	204:19R	Drainable liquid	6.54	6.91	6.72
S97T001587	204:20	Drainable liquid	6.76	7.28	7.02
S97T001588	204:22	Drainable liquid	<6.01	<6.01	<6.01
S97T001607	206:15	Drainable liquid	<1	<1	<1
S97T001608	206:16	Drainable liquid	1.29	1.07	1.18
S97T001609	206:17	Drainable liquid	1.77	1.55	1.66
S97T001610	206:18	Drainable liquid	2.17	2.13	2.15
S97T001639	206:19	Drainable liquid	<6.01	<6.01	<6.01
S97T001640	206:20	Drainable liquid	<6.01	<6.01	<6.01
S97T001641	206:21	Drainable liquid	<6.01	<6.01	<6.01

Table B2-44. Tank 241-AW-104 Analytical Results: Zirconium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			μg/g	μg/g	μg/g
S97T001523	204:18	Lower half	516	440	478
S97T001570	204:19R	Lower half	2,550	2,860	2,710
S97T001597	204:21	Upper half	<221	319	<270[QC:e]
S97T001598		Lower half	2,040	2,040	2,040
S97T001599	204:22	Lower half	<224	<222	<223
S97T001615	206:18	Upper half	289	276	283
S97T001616		Lower half	763	975	869[QC:e]
S97T001659	206:19	Upper half	1,040	1,090	1,070
S97T001665		Lower half	3,050	2,860	2,960
S97T001666	206:20	Lower half	<206	<204	<205
S97T001660	206:21	Upper half	403	536	470[QC:e]
S97T001667		Lower half	<198	<199	<199
S97T001661	206:22	Upper half	<227	<225	<226
S97T001668		Lower half	<199	<200	<200
Liquids			μg/mL	μg/mL	μg/mL
S97T001511	204:15	Drainable liquid	<0.41	<0.41	<0.41
S97T001512	204:16	Drainable liquid	<0.51	<0.51	<0.51
S97T001513	204:17	Drainable liquid	<1.01	<1.01	<1.01
S97T001514	204:18	Drainable liquid	<2.01	<2.01	<2.01
S97T001567	204:19R	Drainable liquid	8.47	<6.01	<7.24[QC:e]
S97T001587	204:20	Drainable liquid	<6.01	<6.01	<6.01
S97T001588	204:22	Drainable liquid	13.8	13.2	13.5
S97T001607	206:15	Drainable liquid	<1	<1	<1
S97T001608	206:16	Drainable liquid	<1	<1	<1
S97T001609	206:17	Drainable liquid	<1	<1	<1
S97T001610	206:18	Drainable liquid	<1	<1	<1
S97T001639	206:19	Drainable liquid	8.13	9.99	9.06[QC:e]
S97T001640	206:20	Drainable liquid	<6.01	<6.01	<6.01
S97T001641	206:21	Drainable liquid	10.3	9.16	9.73

Table B2-45. Tank 241-AW-104 Analytical Results: Bromide (IC).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: water digest			µg/g	µg/g	µg/g
S97T001524	204:18	Lower half	<254	<252	<253
S97T001571	204:19R	Lower half	<295	<300	<298
S97T001600	204:21	Upper half	<557	<550	<553
S97T001601		Lower half	<1,060	<1,090	<1,080
S97T001602	204:22	Lower half	<573	<563	<568
S97T001876	206:18	Upper half	<519	<529	<524
S97T001622		Lower half	<264	<262	<263
S97T001877	206:19	Upper half	<271	<273	<272
S97T001669		Lower half	<264	<259	<261
S97T001670	206:20	Lower half	<522	<527	<524
S97T001663	206:21	Upper half	<962	<933	<948
S97T001671		Lower half	<1,310	<1,290	<1,300
S97T001664	206:22	Upper half	<1,120	<1,120	<1,120
S97T001672		Lower half	<257	<257	<257
Liquids			µg/mL	µg/mL	µg/mL
S97T001511	204:15	Drainable liquid	<265	<265	<265
S97T001512	204:16	Drainable liquid	<518	<518	<518
S97T001513	204:17	Drainable liquid	<265	<265	<265
S97T001514	204:18	Drainable liquid	<265	<265	<265
S97T001567	204:19R	Drainable liquid	<518	<518	<518
S97T001587	204:20	Drainable liquid	<518	<518	<518
S97T001588	204:22	Drainable liquid	<518	<518	<518
S97T001607	206:15	Drainable liquid	<139	<139	<139
S97T001608	206:16	Drainable liquid	<139	<139	<139
S97T001609	206:17	Drainable liquid	<139	<139	<139
S97T001610	206:18	Drainable liquid	<265	<265	<265
S97T001639	206:19	Drainable liquid	<644	<644	<644
S97T001640	206:20	Drainable liquid	<644	<644	<644
S97T001641	206:21	Drainable liquid	<644	<644	<644

Table B2-46. Tank 241-AW-104 Analytical Results: Chloride (IC).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: water digest			μg/g	μg/g	μg/g
S97T001524	204:18	Lower half	873	840	857
S97T001571	204:19R	Lower half	1,890	1,640	1,770
S97T001600	204:21	Upper half	2,290	2,850	2,570[QC:e]
S97T001601		Lower half	3,690	3,480	3,590
S97T001602	204:22	Lower half	3,880	3,900	3,890
S97T001876	206:18	Upper half	922	832	877
S97T001622		Lower half	1,110	1,090	1,100
S97T001877	206:19	Upper half	1,400	1,150	1,270
S97T001669		Lower half	2,090	2,010	2,050
S97T001670	206:20	Lower half	3,260	3,390	3,320
S97T001663	206:21	Upper half	3,530	3,500	3,510
S97T001671		Lower half	3,090	2,870	2,980
S97T001664	206:22	Upper half	2,910	2,710	2,810
S97T001672		Lower half	2,540	2,430	2,480
Liquids			μg/mL	μg/mL	μg/mL
S97T001511	204:15	Drainable liquid	127	138	132
S97T001512	204:16	Drainable liquid	399	420	409
S97T001513	204:17	Drainable liquid	584	572	578
S97T001514	204:18	Drainable liquid	894	999	946
S97T001567	204:19R	Drainable liquid	3,850	3,550	3,700
S97T001587	204:20	Drainable liquid	3,990	4,120	4,050
S97T001588	204:22	Drainable liquid	6,310	6,560	6,440
S97T001607	206:15	Drainable liquid	150	134	142
S97T001608	206:16	Drainable liquid	182	178	180
S97T001609	206:17	Drainable liquid	583	551	567
S97T001610	206:18	Drainable liquid	1,070	1,080	1,070
S97T001639	206:19	Drainable liquid	4,120	3,980	4,050
S97T001640	206:20	Drainable liquid	5,760	5,600	5,680
S97T001641	206:21	Drainable liquid	6,200	6,130	6,170

Table B2-47. Tank 241-AW-104 Analytical Results: Fluoride (IC).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: water digest			µg/g	µg/g	µg/g
S97T001524	204:18	Lower half	605	604	604
S97T001571	204:19R	Lower half	1,140	992	1,070
S97T001600	204:21	Upper half	72,200	86,900	79,600
S97T001601		Lower half	6,530	6,460	6,490
S97T001602	204:22	Lower half	2,300	2,060	2,180[QC:d]
S97T001876	206:18	Upper half	522	422	472[QC:e]
S97T001622		Lower half	503	486	494
S97T001877	206:19	Upper half	658	566	612
S97T001669		Lower half	14,700	14,600	14,600
S97T001670	206:20	Lower half	25,500	25,900	25,700
S97T001663	206:21	Upper half	11,800	11,400	11,600
S97T001671		Lower half	43,500	39,900	41,700[QC:c]
S97T001664	206:22	Upper half	33,800	41,000	37,400
S97T001672		Lower half	143,000	146,000	145,000
Liquids			µg/mL	µg/mL	µg/mL
S97T001511	204:15	Drainable liquid	81	74	77.5
S97T001512	204:16	Drainable liquid	143	157	150
S97T001513	204:17	Drainable liquid	125	786	456[QC:e]
S97T001514	204:18	Drainable liquid	1,110	1,320	1,210[QC:c]
S97T001567	204:19R	Drainable liquid	1,180	1,100	1,140
S97T001587	204:20	Drainable liquid	1,100	1,090	1,100[QC:c]
S97T001588	204:22	Drainable liquid	841	819	830
S97T001607	206:15	Drainable liquid	65.9	110	88[QC:e]
S97T001608	206:16	Drainable liquid	110	130	120
S97T001609	206:17	Drainable liquid	354	349	351
S97T001610	206:18	Drainable liquid	1,230	1,230	1,230
S97T001639	206:19	Drainable liquid	1,170	1,160	1,170
S97T001640	206:20	Drainable liquid	889	870	879[QC:d]
S97T001641	206:21	Drainable liquid	1,110	1,080	1,100

Table B2-48. Tank 241-AW-104 Analytical Results: Nitrate (IC).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: water digest			µg/g	µg/g	µg/g
S97T001524	204:18	Lower half	29,800	30,000	29,900
S97T001571	204:19R	Lower half	57,700	49,400	53,600
S97T001600	204:21	Upper half	61,400	76,000	68700[QC:c]
S97T001601		Lower half	94,800	89,700	92,300
S97T001602	204:22	Lower half	97,700	96,400	97,000
S97T001876	206:18	Upper half	33,000	31,300	32,200
S97T001622		Lower half	36,200	35,400	35,800
S97T001877	206:19	Upper half	46,800	36,800	41800[QC:c]
S97T001669		Lower half	61,800	62,200	62,000
S97T001670	206:20	Lower half	96,000	95,500	95,700
S97T001663	206:21	Upper half	88,400	92,300	90,300
S97T001671		Lower half	72,600	66,200	69400[QC:c]
S97T001664	206:22	Upper half	74,100	71,900	73,000
S97T001672		Lower half	67,000	65,700	66,300
Liquids			µg/mL	µg/mL	µg/mL
S97T001511	204:15	Drainable liquid	15,900	15,900	15,900
S97T001512	204:16	Drainable liquid	20,100	20,500	20,300
S97T001513	204:17	Drainable liquid	27,800	27,500	27,700
S97T001514	204:18	Drainable liquid	35,200	40,700	38,000[QC:d]
S97T001567	204:19R	Drainable liquid	1.15E+05	1.07E+05	1.11E+05
S97T001587	204:20	Drainable liquid	1.22E+05	1.22E+05	1.22E+05
S97T001588	204:22	Drainable liquid	1.51E+05	1.52E+05	1.52E+05[QC:d]
S97T001607	206:15	Drainable liquid	15,600	15,700	15,700
S97T001608	206:16	Drainable liquid	12,200	12,200	12,200
S97T001609	206:17	Drainable liquid	23,700	23,900	23,800
S97T001610	206:18	Drainable liquid	39,500	40,000	39,800
S97T001639	206:19	Drainable liquid	1.23E+05	1.24E+05	1.24E+05
S97T001640	206:20	Drainable liquid	1.63E+05	1.57E+05	1.60E+05
S97T001641	206:21	Drainable liquid	1.63E+05	1.64E+05	1.64E+05

Table B2-49. Tank 241-AW-104 Analytical Results: Nitrite (IC).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: water digest			µg/g	µg/g	µg/g
S97T001524	204:18	Lower half	16,300	16,000	16,200
S97T001571	204:19R	Lower half	34,500	30,700	32,600
S97T001600	204:21	Upper half	45,300	55,300	50,300
S97T001601		Lower half	69,400	67,500	68,400
S97T001602	204:22	Lower half	72,800	70,400	71,600
S97T001876	206:18	Upper half	17,900	17,100	17,500
S97T001622		Lower half	19,900	19,800	19,800
S97T001877	206:19	Upper half	25,800	21,100	23,500[QC:e]
S97T001669		Lower half	35,800	35,500	35,700
S97T001670	206:20	Lower half	60,900	60,100	60,500
S97T001663	206:21	Upper half	61,100	61,500	61,300
S97T001671		Lower half	48,500	44,400	46,400
S97T001664	206:22	Upper half	54,500	50,100	52,300
S97T001672		Lower half	45,000	44,900	45,000
Liquids			µg/mL	µg/mL	µg/mL
S97T001511	204:15	Drainable liquid	4,020	4,000	4,010
S97T001512	204:16	Drainable liquid	7,020	7,130	7,070
S97T001513	204:17	Drainable liquid	12,200	12,000	12,100
S97T001514	204:18	Drainable liquid	18,000	20,700	19,300[QC:d]
S97T001567	204:19R	Drainable liquid	69,200	64,200	66,700
S97T001587	204:20	Drainable liquid	74,900	76,700	75,800[QC:d]
S97T001588	204:22	Drainable liquid	1.14E+05	1.15E+05	1.15E+05[QC:d]
S97T001607	206:15	Drainable liquid	4,230	4,170	4,200
S97T001608	206:16	Drainable liquid	4,370	4,230	4,300
S97T001609	206:17	Drainable liquid	11,300	10,900	11,100
S97T001610	206:18	Drainable liquid	19,900	20,300	20,100
S97T001639	206:19	Drainable liquid	73,100	72,200	72,600
S97T001640	206:20	Drainable liquid	1.02E+05	99,600	1.01E+05
S97T001641	206:21	Drainable liquid	1.11E+05	1.08E+05	1.09E+05

Table B2-50. Tank 241-AW-104 Analytical Results: Phosphate (IC).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: water digest			**µg/g**	**µg/g**	**µg/g**
S97T001524	204:18	Lower half	267	299	283
S97T001571	204:19R	Lower half	558	503	530
S97T001600	204:21	Upper half	2,640	3,070	2,850
S97T001601		Lower half	3,560	3,660	3,610
S97T001602	204:22	Lower half	742	850	796
S97T001876	206:18	Upper half	<498	<508	<503
S97T001622		Lower half	414	376	395
S97T001877	206:19	Upper half	501	486	494
S97T001669		Lower half	1,440	1,420	1,430
S97T001670	206:20	Lower half	2,190	2,160	2,180
S97T001663	206:21	Upper half	1,990	1,710	1,850
S97T001671		Lower half	5,260	4,470	4,870
S97T001664	206:22	Upper half	11,300	5,030	8,180[QC:e]
S97T001672		Lower half	5,870	6,200	6,040
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S97T001511	204:15	Drainable liquid	<255	<255	<255
S97T001512	204:16	Drainable liquid	<497	<497	<497
S97T001513	204:17	Drainable liquid	<255	<255	<255
S97T001514	204:18	Drainable liquid	<255	<255	<255
S97T001567	204:19R	Drainable liquid	900	796	848
S97T001587	204:20	Drainable liquid	781	727	754
S97T001588	204:22	Drainable liquid	686	875	781[QC:e]
S97T001607	206:15	Drainable liquid	<133	<133	<133
S97T001608	206:16	Drainable liquid	<133	<133	<133
S97T001609	206:17	Drainable liquid	<133	<133	<133
S97T001610	206:18	Drainable liquid	261	301	281
S97T001639	206:19	Drainable liquid	953	976	964
S97T001640	206:20	Drainable liquid	703	642	672
S97T001641	206:21	Drainable liquid	789	876	832

Table B2-51. Tank 241-AW-104 Analytical Results: Sulfate (IC).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: water digest			**µg/g**	**µg/g**	**µg/g**
S97T001524	204:18	Lower half	790	941	865
S97T001571	204:19R	Lower half	1,100	799	951[QC:e]
S97T001600	204:21	Upper half	24,300	29,900	27,100[QC:e]
S97T001601		Lower half	20,400	20,200	20,300
S97T001602	204:22	Lower half	9,530	8,800	9,160
S97T001876	206:18	Upper half	1,600	1,840	1,720
S97T001622		Lower half	1,620	1,530	1,570
S97T001877	206:19	Upper half	1,850	1,590	1,720
S97T001669		Lower half	6,710	6,630	6,670
S97T001670	206:20	Lower half	14,900	15,700	15,300
S97T001663	206:21	Upper half	33,200	33,900	33,600
S97T001671		Lower half	24,700	23,100	23,900
S97T001664	206:22	Upper half	27,600	24,200	25,900
S97T001672		Lower half	15,600	15,400	15,500
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S97T001511	204:15	Drainable liquid	<293	<293	<293
S97T001512	204:16	Drainable liquid	<572	<571	<571
S97T001513	204:17	Drainable liquid	811	838	824
S97T001514	204:18	Drainable liquid	1,070	1,350	1,210[QC:e]
S97T001567	204:19R	Drainable liquid	1,220	1,230	1,230
S97T001587	204:20	Drainable liquid	944	769	857[QC:e]
S97T001588	204:22	Drainable liquid	<572	<571	<571
S97T001607	206:15	Drainable liquid	<153	<153	<153
S97T001608	206:16	Drainable liquid	<153	<153	<153
S97T001609	206:17	Drainable liquid	469	<153	<311[QC:e]
S97T001610	206:18	Drainable liquid	1,000	1,060	1,030
S97T001639	206:19	Drainable liquid	1,870	1,970	1,920
S97T001640	206:20	Drainable liquid	852	<711	<782
S97T001641	206:21	Drainable liquid	<711	<711	<711

Table B2-52. Tank 241-AW-104 Analytical Results: Oxalate (IC).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: water digest			μg/g	μg/g	μg/g
S97T001524	204:18	Lower half	657	682	670
S97T001571	204:19R	Lower half	2,010	1,740	1,880
S97T001600	204:21	Upper half	9,570	11,700	10,600[QC:e]
S97T001601		Lower half	3,490	3,090	3,290
S97T001602	204:22	Lower half	3,760	3,850	3,800
S97T001876	206:18	Upper half	<436	<444	<440
S97T001622		Lower half	480	486	483
S97T001877	206:19	Upper half	351	259	305[QC:e]
S97T001669		Lower half	11,400	11,700	11,600
S97T001670	206:20	Lower half	11,600	12,300	11,900
S97T001663	206:21	Upper half	13,900	16,300	15,100
S97T001671		Lower half	12,200	11,600	11,900
S97T001664	206:22	Upper half	19,400	17,600	18,500
S97T001672		Lower half	14,900	14,700	14,800
Liquids			μg/mL	μg/mL	μg/mL
S97T001511	204:15	Drainable liquid	<223	<223	<223
S97T001512	204:16	Drainable liquid	485	492	488
S97T001513	204:17	Drainable liquid	441	490	466
S97T001514	204:18	Drainable liquid	649	890	770[QC:e]
S97T001567	204:19R	Drainable liquid	<435	<435	<435
S97T001587	204:20	Drainable liquid	<435	<435	<435
S97T001588	204:22	Drainable liquid	<435	<435	<435
S97T001607	206:15	Drainable liquid	156	162	159
S97T001608	206:16	Drainable liquid	172	175	173
S97T001609	206:17	Drainable liquid	446	<117	<281[QC:e]
S97T001610	206:18	Drainable liquid	922	859	891
S97T001639	206:19	Drainable liquid	<541	<541	<541
S97T001640	206:20	Drainable liquid	<541	<541	<541
S97T001641	206:21	Drainable liquid	<541	<541	<541

Table B2-53. Tank 241-AW-104 Analytical Results: Bulk Density.

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids			g/mL	g/mL	g/mL
S97T001520	204:18	Lower half	1.2	N/A	1.2
S97T001564	204:19R	Lower half	1.36	N/A	1.36
S97T001585	204:21	Lower half	1.6	N/A	1.6
S97T001586	204:22	Lower half	1.57	N/A	1.57
S97T001624	206:18	Lower half	1.14	N/A	1.14
S97T001635	206:19	Lower half	1.44	N/A	1.44
S97T001636	206:20	Lower half	1.57	N/A	1.57
S97T001637	206:21	Lower half	1.57	N/A	1.57
S97T001638	206:22	Lower half	1.69	N/A	1.69

Table B2-54. Tank 241-AW-104 Analytical Results: Exotherm - Dry Weight Basis (DSC).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Triplicate	Mean
Solids			J/g DW	J/g DW	J/g DW	J/g DW
S97T001646	206:21	Upper half	91.6	87.8		89.7
S97T001651	206:22	Lower half	69.6	72.8		71.2
Liquids			J/g DW	J/g DW	J/g DW	J/g DW
S97T001587	204:20	Drainable liquid	69.3	34.3	70.1	57.9
S97T001588	204:22	Drainable liquid	51.2	55.1		53.1
S97T001641	206:21	Drainable liquid	111	67.1	63.8	80.5[QC:e]

Table B2-55. Tank 241-AW-104 Analytical Results: Exotherm - Wet Weight Basis (DSC).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Triplicate	Mean
Solids			**J/g**	**J/g**	**J/g**	**J/g**
S97T001646	206:21	Upper half	51.3	49.2		50.2
S97T001651	206:22	Lower half	51.8	54.2		53
Liquids			**J/g**	**J/g**	**J/g**	**J/g**
S97T001587	204:20	Drainable liquid	30.2	14.9	30.5	25.2[QC:e]
S97T001588	204:22	Drainable liquid	25	26.9		26
S97T001641	206:21	Drainable liquid	57.5	34.8	33.2	41.8[QC:e]

Table B2-56. Tank 241-AW-104 Analytical Results: Percent Water (TGA).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids			%	%	%
S97T001521	204:18	Lower half	73.4	75	74.2
S97T001997	204:19R	Lower half	61.9	62.8	62.4
S97T001591	204:21	Upper half	42.5	39.5	41
S97T001592		Lower half	43.4	46.1	44.7
S97T001593	204:22	Lower half	48	43.7	45.9
S97T001617	206:18	Upper half	74.2	71.5	72.8
S97T001618		Lower half	69.5	70.2	69.8
S97T001645	206:19	Upper half	62.5	59.5	61
S97T001648		Lower half	54.6	53.9	54.3
S97T001649	206:20	Lower half	51.9	52	51.9
S97T001646	206:21	Upper half	44.3	43.7	44
S97T001650		Lower half	41.7	42.9	42.3
S97T001647	206:22	Upper half	36.9	45.1	41
S97T001651		Lower half	26	25.1	25.6
Liquids			%	%	%
S97T001511	204:15	Drainable liquid	95.3	95.4	95.4
S97T001512	204:16	Drainable liquid	93.2	93	93.1
S97T001513	204:17	Drainable liquid	89.5	88.9	89.2
S97T001514	204:18	Drainable liquid	83.4	83.4	83.4
S97T001567	204:19R	Drainable liquid	59.8	59.5	59.6
S97T001587	204:20	Drainable liquid	56.5	56.4	56.5
S97T001588	204:22	Drainable liquid	51.1	51.1	51.1
S97T001607	206:15	Drainable liquid	94.7	94.7	94.7
S97T001608	206:16	Drainable liquid	92.8	92.9	92.8
S97T001609	206:17	Drainable liquid	88.1	88	88.1
S97T001610	206:18	Drainable liquid	83.4	83.3	83.4
S97T001639	206:19	Drainable liquid	58.8	58.1	58.4
S97T001640	206:20	Drainable liquid	54.8	54.4	54.6
S97T001641	206:21	Drainable liquid	47.2	48.9	48

Table B2-57. Tank 241-AW-104 Analytical Results: Percent Water (Gravimetry).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids			%	%	%
S97T001521	204:18	Lower half	75.4	75.1	75.3
S97T001566	204:19R	Lower half	58	58	58
S97T001591	204:21	Upper half	35.7	34.6	35.2
S97T001592		Lower half	44.3	44.9	44.6
S97T001593	204:22	Lower half	41.6	41.9	41.8
S97T001617	206:18	Upper half	65.4	79.2	72.3
S97T001618		Lower half	72.3	70.6	71.4
S97T001645	206:19	Upper half	64.7	65.3	65
S97T001648		Lower half	56	55.3	55.6
S97T001649	206:20	Lower half	52.8	51.8	52.3
S97T001646	206:21	Upper half	48.9	48.7	48.8
S97T001650		Lower half	48.6	50	49.3
S97T001647	206:22	Upper half	49.3	47.1	48.2
S97T001651		Lower half	25.4	26.6	26

Table B2-58. Tank 241-AW-104 Analytical Results: Specific gravity (SpG).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Liquids			unitless	unitless	unitless
S97T001511	204:15	Drainable liquid	1	1	1
S97T001512	204:16	Drainable liquid	1.04	1.03	1.04
S97T001513	204:17	Drainable liquid	1.06	1.06	1.06
S97T001514	204:18	Drainable liquid	1.1	1.12	1.11
S97T001567	204:19R	Drainable liquid	1.48	1.47	1.47
S97T001587	204:20	Drainable liquid	1.44	1.43	1.44
S97T001588	204:22	Drainable liquid	1.44	1.46	1.45
S97T001607	206:15	Drainable liquid	1.04	1.03	1.03
S97T001608	206:16	Drainable liquid	1.05	1.07	1.06
S97T001609	206:17	Drainable liquid	1.1	1.07	1.09
S97T001610	206:18	Drainable liquid	1.14	1.15	1.14
S97T001639	206:19	Drainable liquid	1.39	1.36	1.38
S97T001640	206:20	Drainable liquid	1.47	1.49	1.48
S97T001641	206:21	Drainable liquid	1.38	1.42	1.4

Table B2-59. Tank 241-AW-104 Analytical Results: Total Alpha.

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			µCi/g	µCi/g	µCi/g
S97T001523	204:18	Lower half	1.38	1.45	1.42[QC:f]
S97T001570	204:19R	Lower half	3.48	3.3	3.39
S97T001598	204:21	Lower half	0.156	0.165	0.161[QC:f]
S97T001599	204:22	Lower half	0.0289	0.0233	0.0261[QC:e,f]
S97T001616	206:18	Lower half	1.66	1.91	1.78
S97T001665	206:19	Lower half	4.49	4.35	4.42
S97T001666	206:20	Lower half	0.207	0.146	0.177[QC:e]
S97T001667	206:21	Lower half	0.159	0.121	0.14[QC:e,f]
S97T001668	206:22	Lower half	0.0474	0.0376	0.0425[QC:e,f]
Liquids			µCi/mL	µCi/mL	µCi/mL
S97T001511	204:15	Drainable liquid	<2.67E-04	<4.56E-04	<3.62E-04
S97T001512	204:16	Drainable liquid	3.72E-04	<3.44E-04	<3.58E-04
S97T001513	204:17	Drainable liquid	<4.56E-04	<2.60E-04	<3.58E-04
S97T001514	204:18	Drainable liquid	<0.00114	<0.00243	<0.00179
S97T001567	204:19R	Drainable liquid	<0.00539	<0.00973	<0.00756[QC:f]
S97T001587	204:20	Drainable liquid	<0.0083	<0.0083	<0.0083[QC:f]
S97T001588	204:22	Drainable liquid	<0.0105	<0.0137	<0.0121[QC:f]
S97T001607	206:15	Drainable liquid	3.14E-04	<3.01E-04	<3.08E-04[QC:f]
S97T001608	206:16	Drainable liquid	<7.53E-04	7.53E-04	<7.53E-04[QC:f]
S97T001609	206:17	Drainable liquid	<0.00132	0.00163	<0.00148[QC:e,f]
S97T001610	206:18	Drainable liquid	0.00289	0.00289	0.00289[QC:f]
S97T001639	206:19	Drainable liquid	0.00594	0.00765	0.0068[QC:e,f]
S97T001640	206:20	Drainable liquid	0.0107	<0.0199	<0.0153[QC:e,f]
S97T001641	206:21	Drainable liquid	0.0119	0.00388	0.00789[QC:e,f]

Table B2-60. Tank 241-AW-104 Analytical Results: Total Inorganic Carbon (Persulfate Oxidation).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Triplicate	Mean
Solids			**µg/g**	**µg/g**	**µg/g**	**µg/g**
S97T001646	206:21	Upper half	11,200	13,000	14,900	13,000[QC:d]
S97T001651	206:22	Lower half	5,260	6,590	6,170	6,010[QC:e]
Liquids			**µg/mL**	**µg/mL**	**µg/mL**	**µg/mL**
S97T001587	204:20	Drainable liquid	11,500	11,800	---	11,700
S97T001588	204:22	Drainable liquid	3,000	3,060	---	3,030
S97T001641	206:21	Drainable liquid	6,220	5,790	---	6,010[QC:d]

Table B2-61. Tank 241-AW-104 Analytical Results: Total Organic Carbon (Persulfate Oxidation).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Triplicate	Mean
Solids			**µg/g**	**µg/g**	**µg/g**	**µg/g**
S97T001646	206:21	Upper half	4,050	6,430	5,420	5,300[QC:e]
S97T001651	206:22	Lower half	7,680	6,610	---	7,150
Liquids			**µg/mL**	**µg/mL**	**µg/mL**	**µg/mL**
S97T001587	204:20	Drainable liquid	2,870	2,950	---	2,910
S97T001588	204:22	Drainable liquid	3,890	3,950	---	3,920
S97T001641	206:21	Drainable liquid	4,650	4,360	---	4,510[QC:d]

B3.0 ASSESSMENT OF CHARACTERIZATION RESULTS

This section discusses the overall quality and consistency of the current sampling results for tank 241-AW-104 and provides the results of an analytical-based inventory calculation. It also evaluates sampling and analysis factors that may affect data interpretation. These factors are used to assess overall data quality and consistency and to identify limitations in data use.

B3.1 FIELD OBSERVATIONS

Sample recovery for cores 204 and 206 were good for most segments. Seven of the 16 total segments had recoveries over 90 percent, while only one segment had a recovery below 64 percent (segment 20 of core 204 had a 35 percent recovery). The only problem noted during sampling was a failure of the sampler while taking segment 19 of core 204 (Steen 1997). The sampling operator noted that a loud pop was heard when the sampler was lifted from the bit, and on retrieval the piston was sticking out of the bottom of the sampler. The segment was successfully retaken. The retaking of segment 19 may have contributed to the 35 percent recovery for segment 20. Interestingly, this segment was composed solely of drainable liquid. The lithium and bromide analytical results were below detection limits, however, indicating that the recovered liquid was not hydrostatic head fluid. The sampling operator suspected that a possible error in the hydrostatic head pressure may have allowed liquids to back up into the drill string.

Although tank 241-AW-104 contained a total of 1,030 cm (466 in.) of waste, the expected depth of the tank solids layer was 366 cm (744 in); hence, eight segments were taken for each core. The top segment was expected to be about 40 percent liquid (by volume). The sampling results revealed that tank 241-AW-104 contains less solids than previously believed. Solids were not observed until the fourth segment of each core. The solids recoveries indicated that the solids depth under riser 13A (core 204) was approximately 210 cm (82.7 in.), while that under riser 15A (core 206) was 212 cm (83.5 in.). The similarity in the solids depth estimates, coupled with the slurry-like consistency of the solids, suggests that the solids waste layer is fairly even across the tank.

B3.2 QUALITY CONTROL ASSESSMENT

The usual QC assessment includes an evaluation of the appropriate standard recoveries, spike recoveries, duplicate analyses, and blanks performed in conjunction with the chemical analyses. All pertinent QC tests were conducted on the 1997 core samples, allowing a full assessment regarding the accuracy and precision of the data. The SAP (Benar 1997) established specific criteria for the required analytes. Sample and duplicate pairs with one or more QC results outside the specified criteria were identified by footnotes in the data summary tables.

The standard and spike recovery results provide an estimate of analysis accuracy. If a standard or spike recovery is above or below the given criterion, the analytical results may be biased high or low, respectively. The precision is estimated by the relative percent difference (RPD), which is defined as the absolute value of the difference between the primary and duplicate samples, divided by their mean, times 100. High RPDs (>20 percent) were reported for 6 of the 24 subsamples submitted for analysis. Selected samples were reanalyzed with little or no improvement in RPDs. The chemist noted that the high RPDs were caused by sample inhomogeneity (Steen 1997). No reruns were requested because of the low alpha activity in the samples. Alpha activity was detected in the method blank for this analysis. However, because the level of contamination was insignificant with respect to the sample results, the useability of the results was unaffected.

RPDs greater than 20 percent were reported for two of the 29 DSC subsamples submitted for analysis. The nonhomogeneous material and small sample size for this analysis made it difficult to obtain reproducible results. Triplicate analyses were performed for these two samples. No further analyses were requested. An RPD greater than 20 percent was reported for one TOC sample. The high RPD was attributed to the heterogeneous nature of the samples. No rerun was requested. A spike recovery outside of the required limits (75 to 125 percent was reported for one sample. The chemist attributed the high spike recovery to sample inhomogeneity based on differences in appearance between the sample, duplicate, and spike aliquots (Steen 1997).

Quality control results for all other analytes required by the SAP were within the boundaries specified. It should be noted that the SAP required only lithium from the ICP analysis and bromide from the IC analysis. Because results for the other ICP and IC analytes were not required by the SAP and were reported on an "opportunistic" basis only, no QC parameters were applied to them. Had the QC requirements applied to lithium been applied to the rest of the ICP analytes, most of the analytes showed few if any problems. Problems in spike recoveries were noted for a few samples for aluminum, potassium, silicon, and sodium. Blank contamination was noted in several samples for silicon and zirconium. When applying the bromide QC criteria to the opportunistic IC analytes, minor problems are noted in spike recoveries for fluoride, nitrate, and nitrite. Blank contamination was noted in a few samples for fluoride, oxalate, and sulfate.

In summary, the vast majority of QC results were within the boundaries specified in the SAPs. The discrepancies mentioned here and footnoted in the data summary tables should not affect data validity or use.

B3.3 DATA CONSISTENCY CHECKS

Comparing different analytical methods is helpful in assessing the consistency and quality of the data. Several comparisons were possible with the data set provided by the two core samples: comparing phosphorus and sulfur as analyzed by ICP to phosphate and sulfate as analyzed by IC, and comparing weight percent water by TGA to the weight percent water by gravimetry. In addition, mass and charge balances were calculated to help assess the overall data consistency.

B3.3.1 Comparison of Results from Different Analytical Methods

The following data consistency checks compare the results from two analytical methods. Agreement between the two methods strengthens the credibility of both results, but poor agreement brings the reliability of the data into question. All analytical mean results were taken from Section B2.0 tables.

For the solids, comparing phosphorus by ICP to phosphate by IC was not practical, because the results for all the phosphorus samples except one were below detection limits. For the drainable liquid, the analytical phosphorous mean result as determined by ICP was 338 μg/mL, which converts to 1,040 μg/mL of phosphate. This did not compare well with the IC phosphate mean result of 485 μg/mL. The RPD between these two phosphate values was 73 percent. However, 7 of the 14 phosphate samples had results below detection limits. A better comparison can be made by evaluating the individual results for the samples with concentrations above detection limits. Table B3-1 presents this comparison. Again, the values do not compare well. A possible explanation is the ICP subsamples are subjected to an acid adjustment before analysis, while the IC analysis is done directly. If phosphate crystals are present in the liquid, the acid adjustment will digest them and their amount will be reflected in the ICP analytical result. The IC analysis, however, will not include the phosphate contribution from the crystals.

Table B3-1. Phosphorus/Phosphate Comparison for Drainable Liquid Samples with Detected Results. (2 sheets)

Sample Location	P (as PO_4) by ICP	PO_4 by IC	RPD
Core: segment	μg/mL	μg/mL	%
204:19R	1,560	848	59
204:20	1,500	754	66
204:22	1,440	781	59
206:18	959	281	109
206:19	1,730	964	57

Table B3-1. Phosphorus/Phosphate Comparison for Drainable Liquid Samples with Detected Results. (2 sheets)

Sample Location	P (as PO_4) by ICP	PO_4 by IC	RPD
Core: segment	μg/mL	μg/mL	%
206:20	1,240	672	59
206:21	2,450	832	99

The sulfur/sulfate comparison also gave mixed results. For the solids, the sulfur mean of 5,330 μg/g converted to 15,990 μg/g of sulfate. The measured sulfate mean was 11,900, yielding an RPD of 29 percent. The sulfur mean for the drainable liquid was 520 μg/mL, or 1,560 μg/mL of sulfate. The measured sulfate mean was 758 μg/mL. In this case the sulfate values did not compare well; the RPD between the two values was 69 percent. However, similar to phosphate, 8 of 14 samples for sulfate had results below detection limits. The comparison was redone based on the individual results for samples with concentrations greater than detection limits. Table B3-2 presents this comparison. Results were mixed again; RPDs for three of the six samples demonstrated good agreement, while the other three exhibited poor agreement.

Table B3-2. Sulfur/Sulfate Comparison for Drainable Liquid Samples with Detected Results.

Sample Location	S (as SO_4) by ICP	SO_4 by IC	RPD
Core: segment	μg/mL	μg/mL	%
204:17	867	824	5.1
204:18	1,460	1,210	19
204:19R	2,820	1,230	79
204:20	2,850	857	108
206:18	1,320	1,030	25
206:19	3,480	1,920	58

Weight percent water was performed by both TGA and gravimetry on the solids samples. The mean weight percent water results were 53.4 percent and 53.7 percent as determined by TGA and gravimetry, respectively. The agreement between the values was excellent, as evidenced by the RPD of 0.56 percent.

B3.3.2 Mass and Charge Balance

The principal objective in performing mass and charge balances is to determine whether the measurements are consistent. Separate mass and charge balances were performed for the solids and drainable liquid. In calculating the balances, only the analytes listed in Tables B3-9 and B3-10 that were detected at a concentration of 1,000 μg/g or greater were considered.

Except for sodium, all cations listed in Table B3-3 (solids) were assumed to be in their most common hydroxide or oxide form, and the concentrations of the assumed species were calculated stoichiometrically. Because precipitates are neutral species, all positive charge was attributed to sodium. The anions listed in Table B3-4 (solids), except for silicon dioxide, were assumed to be present as sodium salts and were expected to balance the positive charge exhibited by sodium. For the solids, phosphate (as determined by IC) is assumed to be completely water soluble and appears only in the anion mass and charge calculations. The mass/charge balances for the cations and anions in the drainable liquid are presented in Tables B3-6 and B3-7, respectively.

Total organic carbon and TIC were included in the mass and charge balances, although true tank means were not available. According to the SAP (Benar 1997), TOC analyses were required only on those samples with exotherms. Consequently, only the five samples (two solids and three drainable liquid) that displayed exothermic behavior were analyzed for TOC and TIC. The solids mean is based on an average of two samples, while the drainable liquid mean is based on an average of three. The TOC and TIC means should be used with caution because they may not represent the entire tank waste profile.

The concentrations of the cationic and anionic species, along with the percent water, were ultimately used to calculate the mass balance, shown in Table B3-5 for the solids and Table B3-8 for the drainable liquid. The mass balance was calculated from the following formula. The factor 0.0001 is the conversion factor from μg/g to weight percent.

Mass balance = Percent water + 0.0001 x {total analyte concentration}

For the solids, the total analyte concentration calculated from the above equation is 487,000 μg/g. The mean weight percent water (obtained from the TGA mean in Table B3-9) is 53.4 percent or 534,000 μg/g. The mass balance resulting from adding the percent water to the total analyte concentration is 102 percent (see Table B3-5). For the drainable liquid, the mass balance derived by summing the TGA mean (74.9 percent or 749,000 μg/g) and the total analyte concentration (244,000 μg/g) was 99.3 percent.

The charge balance is obtained by dividing the sum of the positive charge by the sum of the negative charge. Based solely on measured constituents, both the solids and drainable liquid had a net positive charge. However, hydroxide was not analyzed. Because hydroxide is expected to exist in tank 241-AW-104, the assumption is made that the net positive charge is offset by hydroxide, thereby rendering a total charge of zero, as shown in Tables B3-5 and B3-8.

In summary, the previous calculations yield reasonable mass balance values (close to 100 percent). An assessment of data consistency is difficult with the charge balances. Without the hydroxide concentration assumption, the solids charge balance did not show good agreement. However, this would be expected if hydroxide was present in significant quantities. The supernatant charge balance showed fair agreement before adding the hydroxide.

Table B3-3. Cation Mass and Charge Data (Solids).

Analyte	Concentration[1] (µg/g)	Assumed Species	Concentration of Assumed Species (µg/g)	Charge (µeq/g)
Aluminum	16,000	$Al(OH)_3$	46,200	0
Chromium	2,050	$Cr(OH)_3$	4,060	0
Iron	5,070	FeO(OH)	8,060	0
Manganese	1,660	MnO(OH)	2,660	0
Sodium	166,000	Na^+	166,000	7,220
Totals:			227,000	7,220

Note:
[1]Concentration values are taken from Table B3-9.

Table B3-4. Anion Mass and Charge Data (Solids). (2 sheets)

Analyte	Concentration[1] (µg/g)	Assumed Species	Concentration of Assumed Species (µg/g)	Charge (µeq/g)
Chloride	2,380	Cl^-	2,380	67
Fluoride	25,500	F^-	25,500	1,340
Nitrate	65,600	NO_3^-	65,600	1,060
Nitrite	43,400	NO_2^-	43,400	943
Oxalate	6,820	$C_2O_4^{-2}$	6,820	155
Phosphate	2,170	PO_4^{-3}	2,170	68.5

Table B3-4. Anion Mass and Charge Data (Solids). (2 sheets)

Analyte	Concentration[1] ($\mu g/g$)	Assumed Species	Concentration of Assumed Species ($\mu g/g$)	Charge ($\mu eq/g$)
Silicon	1,600	SiO_2	3,430	0
Sulfate	11,900	SO_4^{2-}	11,900	248
TIC	9,520[2]	CO_3^{-2}	47,600	793
TOC	6,170[3]	$C_2H_3O_2^-$	10,600[4]	180
Hydroxide	40,300[5]	OH^-	40,300	2,370
Totals:			260,000	7,220

Notes:

[1]Concentration values were taken from Table B3-9.

[2]The TIC concentration was based on an average of the results from the two samples analyzed for TIC. This value is not a true tank mean, and may not be a good representation of the TIC concentration in the tank.

[3]The TOC concentration was based on an average of the results from the two samples analyzed for TOC. This value is not a true tank mean, and may not be a good representation of the TOC concentration in the tank.

[4]The acetate value has been corrected for the contribution of oxalate to TOC.

[5]The hydroxide concentration is derived from the difference in charge between the cation and anion totals.

Table B3-5. Mass and Charge Balance Totals (Solids).

Totals	Concentrations ($\mu g/g$)	Charge ($\mu eq/g$)
Total from Table B3-3 (cations)	227,000	7,220
Total from Table B3-4 (anions)	260,000	-7,220
Water percent	534,000	0
Totals:	1,021,000	0

Table B3-6. Cation Mass and Charge Data (Supernatant).

Analyte	Concentration[1] (μg/mL)	Concentration[2] (μg/g)	Assumed Species	Concentration of Assumed Species (μg/g)	Charge (μeq/g)
Potassium	7,030	5,620	K^+	5,620	144
Sodium	99,100	79,300	Na^+	79,300	3,450
Totals:				84,900	3,590

Notes:

[1]Concentration values are taken from Table B3-10.

[2]The μg/mL values were converted to μg/g using the mean drainable liquid specific gravity of 1.25.

Table B3-7. Anion Mass and Charge Data (Supernatant).

Analyte	Concentration[1] (μg/mL)	Concentration[2] (μg/g)	Assumed Species	Concentration of Assumed Species (μg/g)	Charge (μeq/g)
Aluminum	11,800	9,440	AlO_2^-	20,600	349
Chloride	2,440	1,950	Cl^-	1,950	55.0
Nitrate	73,200	58,600	NO_3^-	58,600	945
Nitrite	44,400	35,500	NO_2^-	35,500	772
TIC	6,900[3]	5,520	CO_3^{-2}	27,600	920
TOC	3,840[4]	3,070	$C_2H_3O_2^-$	7,550	128
Hydroxide	8,950[5]	7,160	OH^-	7,160	421
Totals:				159,000	3,590

Notes:

[1]Concentration values were taken from Table B3-10.

[2]The μg/mL values were converted to μg/g using the mean drainable liquid specific gravity of 1.25.

[3]The TIC concentration was based on an average of the results from the three samples analyzed for TIC. This value is not a true tank mean, and may not be a good representation of the TIC concentration in the tank.

[4]The TOC concentration was based on an average of the results from the three samples analyzed for TOC. This value is not a true tank mean, and may not be a good representation of the TOC concentration in the tank.

[5]The hydroxide concentration was derived from the difference in charge between the cation and anion totals.

Table B3-8. Mass and Charge Balance Totals (Supernatant).

Totals	Concentrations (μg/g)	Charge (μeq/g)
Total from Table B3-6 (cations)	84,900	3,450
Total from Table B3-7 (anions)	159,000	-3,450
Water percent	749,000	0
Totals:	992,900	0

B3.4 MEAN CONCENTRATIONS AND CONFIDENCE INTERVALS

B3.4.1 Solid Data

A nested analysis of variance (ANOVA) model was fit to the core segment data. Mean values and 95 percent confidence intervals on the mean were determined from the ANOVA. Four variance components were used in the calculations. The variance components represent concentration differences between risers, segments, laboratory samples, and analytical replicates. The model is

$$Y_{ijk} = \mu + R_i + S_{ij} + L_{ijk} + A_{ijkm},$$

$$i=1,2,\ldots,a;\ j=1,2,\ldots,b_i;\ k=1,2,\ldots,c_{ij};m=1,2,\ldots,n_{ijk}$$

where

Y_{ijkm} = concentration from the m[th] analytical result of the k[th] sample of the j[th] segment of the i[th] riser

μ = the mean

R_i = the effect of the i[th] riser

S_{ij} = the effect of the j[th] segment from the i[th] riser

L_{ijk} = the effect of the k[th] sample from the j[th] segment of the i[th] riser

A_{ijkm} = the analytical error

a = the number of risers

b_i = the number of segments from the i^{th} riser

c_{ij} = the number of samples from the j^{th} segment of the i^{th} riser

n_{ijk} = the number of analytical results from the ijk^{th} sample

The variables R_i, S_{ij}, and L_{ijk} are random effects. These variables, as well as A_{ijkm}, are assumed to be uncorrelated and normally distributed with means zero and variances $\sigma^2(R)$, $\sigma^2(S)$, $\sigma^2(L)$ and $\sigma^2(A)$, respectively.

The restricted maximum likelihood method (REML) was used to estimate the mean concentration and standard deviation of the mean for all analytes that had 50 percent or more of their reported values greater than the detection limit. The REML method, applied to variance component estimation, is described in Harville (1977). The statistical results were obtained using the statistical analysis package S-PLUS (Statistical Sciences 1993). The mean value and standard deviation of the mean were used to calculate the 95 percent confidence intervals. The following table gives the mean, degrees of freedom, and confidence interval for each constituent.

Some analytes had results that were below the detection limit. In these cases the value of the detection limit was used for non-detected results. For analytes with a majority of results below the detection limit, a simple average is all that is reported.

The lower and upper limits [LL(95%) and UL(95%)] of a two-sided 95 percent confidence interval on the mean were calculated using the following equation:

$$LL(95\%) = \hat{\mu} - t_{(df,\ 0.025)} \times \hat{\sigma}(\hat{\mu}),$$
$$UL(95\%) = \hat{\mu} + t_{(df,\ 0.025)} \times \hat{\sigma}(\hat{\mu}).$$

In this equation, $\hat{\mu}$ is the REML estimate of the mean concentration, , $\hat{\sigma}(\hat{\mu})$ is the REML estimate of the standard deviation of the mean, and $t_{(df,\ 0.025)}$ is the quantile from Student's t distribution with *df* degrees of freedom. The degrees of freedom equals the number of risers with data minus one. In cases where the lower limit of the confidence interval was negative, it is reported as zero.

Table B3-9. Tank 241-AW-104 95 Percent Two-Sided Confidence Interval for the Mean Concentration for Solid Subdivision Data. (2 sheets)

Analyte	Method	Mean	df	LL	UL	Units
Aluminum	ICP:F	1.60E+04	1	0	4.31E+04	μg/g
Antimony[1]	ICP:F	<1.32E+03	N/A	N/A	N/A	μg/g
Arsenic[1]	ICP:F	<2.14E+03	N/A	N/A	N/A	μg/g
Barium[1]	ICP:F	<1.07E+03	N/A	N/A	N/A	μg/g
Beryllium[1]	ICP:F	<1.07E+02	N/A	N/A	N/A	μg/g
Bismuth[1]	ICP:F	<2.14E+03	N/A	N/A	N/A	μg/g
Boron[1]	ICP:F	<1.07E+03	N/A	N/A	N/A	μg/g
Bromide[1]	IC:W	<5.87E+02	N/A	N/A	N/A	μg/g
Cadmium[1]	ICP:F	<1.14E+02	N/A	N/A	N/A	μg/g
Calcium[1]	ICP:F	<2.84E+03	N/A	N/A	N/A	μg/g
Cerium[1]	ICP:F	<2.14E+03	N/A	N/A	N/A	μg/g
Chloride	IC:W	2.38E+03	1	0	6.96E+03	μg/g
Chromium[1]	ICP:F	2.05E+03	1	0	1.05E+04	μg/g
Cobalt[1]	ICP:F	<4.29E+02	N/A	N/A	N/A	μg/g
Copper[1]	ICP:F	<2.14E+02	N/A	N/A	N/A	μg/g
Density	Density	1.47	N/A	N/A	N/A	g/mL
Fluoride	IC:W	2.55E+04	1	0	1.71E+05	μg/g
Iron[1]	ICP:F	5.07E+03	1	0	2.41E+04	μg/g
Lanthanum[1]	ICP:F	<1.07E+03	N/A	N/A	N/A	μg/g
Lead[1]	ICP:F	<2.14E+03	N/A	N/A	N/A	μg/g
Lithium[1]	ICP:F	<2.14E+02	N/A	N/A	N/A	μg/g
Magnesium[1]	ICP:F	<2.14E+03	N/A	N/A	N/A	μg/g
Manganese[1]	ICP:F	1.66E+03	1	0	9.46E+03	μg/g
Molybdenum[1]	ICP:F	<1.07E+03	N/A	N/A	N/A	μg/g
Neodymium[1]	ICP:F	<2.14E+03	N/A	N/A	N/A	μg/g
Nitrate	IC:W	6.56E+04	1	0	1.68E+05	μg/g
Nitrite	IC:W	4.34E+04	1	0	1.26E+05	μg/g
Oxalate[1]	IC:W	6.82E+03	1	0	4.47E+04	μg/g
Percent water	TGA	5.34E+01	1	0	1.12E+02	%
Percent water	Gravimetry	5.37E+01	1	0	1.12E+02	%
Phosphate[1]	IC:W	2.17E+03	1	0	1.20E+04	μg/g

Table B3-9. Tank 241-AW-104 95 Percent Two-Sided Confidence Interval for the Mean Concentration for Solid Subdivision Data. (2 sheets)

Analyte	Method	Mean	df	LL	UL	Units
Phosphorus[1]	ICP:F	<4.43E+03	N/A	N/A	N/A	µg/g
Samarium[1]	ICP:F	<2.14E+03	N/A	N/A	N/A	µg/g
Silicon[1]	ICP:F	1.60E+03	1	0	5.24E+03	µg/g
Silver[1]	ICP:F	<2.14E+02	N/A	N/A	N/A	µg/g
Sodium	ICP:F	1.66E+05	1	0	4.90E+05	µg/g
Strontium[1]	ICP:F	<2.14E+02	N/A	N/A	N/A	µg/g
Sulfate	IC:W	1.19E+04	1	0	5.83E+04	µg/g
Sulfur[1]	ICP:F	5.33E+03	1	0	2.05E+04	µg/g
Thallium[1]	ICP:F	<4.29E+03	N/A	N/A	N/A	µg/g
Titanium[1]	ICP:F	<2.14E+02	N/A	N/A	N/A	µg/g
Total alpha	Alpha:F	1.28	1	0	8.22	µCi/g
Total inorganic carbon	Persulfate oxidation	9.52E+03	1	0	5.42E+04	µg/g
Total organic carbon	Persulfate oxidation	6.17E+03	1	0	1.79E+04	µg/g
Uranium[1]	ICP:F	<1.84E+04	N/A	N/A	N/A	µg/g
Vanadium[1]	ICP:F	<1.07E+03	N/A	N/A	N/A	µg/g
Zinc[1]	ICP:F	<2.91E+02	N/A	N/A	N/A	µg/g
Zirconium[1]	ICP:F	8.72E+02	1	0.00E+00	4.42E+03	µg/g

Note:
[1]A "less than" value was used in the calculation.

B3.4.2 Liquid Data

The model fit to the liquid data was a nested ANOVA model. The model determined the mean value and 95 percent confidence interval for each constituent. Two variance components were used in the calculations. The variance components represent concentration differences between samples taken from different risers, and between analytical replicates. The model is

$$Y_{ijk} = \mu + R_i + A_{ij},$$

$$i=1,2,\ldots,a;\ j=1,2,\ldots,n_i;$$

where

Y_{ijk} = concentration from the kth analytical result of the jth sample from the ith segment

μ = the mean

R_i = the effect of the ith riser

A_{ij} = the analytical error

a = the number of segments

n_i = the number of analytical results from the ith riser

The variable R_i is a random effect. This variable, along with A_{ij}, is assumed to be uncorrelated and normally distributed with means zero and variances $\sigma^2(R)$, and $\sigma^2(A)$ respectively. The *df* associated with the standard deviation of the mean is the number of risers with data minus one.

Table B3-10. Tank 241-AW-104 95 Percent Two-Sided Confidence Interval for the Mean Concentration for Liquid Subdivision Data. (3 sheets)

Analyte	Method	Mean	df	LL	UL	Units
Aluminum	ICP	1.18E+04	1	0	5.71E+04	µg/mL
Antimony[1]	ICP	<1.89E+01	N/A	N/A	N/A	µg/mL
Arsenic[1]	ICP	<3.14E+01	N/A	N/A	N/A	µg/mL
Barium[1]	ICP	<1.57E+01	N/A	N/A	N/A	µg/mL
Beryllium[1]	ICP	<1.57	N/A	N/A	N/A	µg/mL
Bismuth[1]	ICP	<3.14E+01	N/A	N/A	N/A	µg/mL
Boron[1]	ICP	2.13E+01	1	0	8.78E+01	µg/mL
Bromide[1]	IC	<3.91E+02	N/A	N/A	N/A	µg/mL
Cadmium[1]	ICP	<1.77	N/A	N/A	N/A	µg/mL
Calcium[1]	ICP	<3.14E+01	N/A	N/A	N/A	µg/mL
Cerium[1]	ICP	<3.14E+01	N/A	N/A	N/A	µg/mL
Chloride	IC	2.44E+03	1	0	1.08E+04	µg/mL
Chromium	ICP	3.16E+01	1	0	1.62E+02	µg/mL
Cobalt[1]	ICP	<6.28	N/A	N/A	N/A	µg/mL
Copper[1]	ICP	<3.16	N/A	N/A	N/A	µg/mL

Table B3-10. Tank 241-AW-104 95 Percent Two-Sided Confidence Interval for the Mean Concentration for Liquid Subdivision Data. (3 sheets)

Analyte	Method	Mean	df	LL	UL	Units
Fluoride	IC	7.07E+02	1	0	2.31E+03	μg/mL
Iron[1]	ICP	<1.57E+01	N/A	N/A	N/A	μg/mL
Lanthanum[1]	ICP	<1.57E+01	N/A	N/A	N/A	μg/mL
Lead[1]	ICP	<3.14E+01	N/A	N/A	N/A	μg/mL
Lithium[1]	ICP	<3.14	N/A	N/A	N/A	μg/mL
Magnesium[1]	ICP	<3.14E+01	N/A	N/A	N/A	μg/mL
Manganese[1]	ICP	<3.65	N/A	N/A	N/A	μg/mL
Molybdenum[1]	ICP	2.93E+01	1	0	1.26E+02	μg/mL
Neodymium[1]	ICP	<3.14E+01	N/A	N/A	N/A	μg/mL
Nickel[1]	ICP	<6.31	N/A	N/A	N/A	μg/mL
Nitrate	IC	7.32E+04	1	0	2.80E+05	μg/mL
Nitrite	IC	4.44E+04	1	0	1.91E+05	μg/mL
Oxalate[1]	IC	<4.56E+02	N/A	N/A	N/A	μg/mL
Percent water	TGA	7.49E+01	1	1.15E+01	1.38E+02	%
Phosphate[1]	IC	4.85E+02	1	0	1.54E+03	μg/mL
Phosphorus	ICP	3.38E+02	1	0	1.06E+03	μg/mL
Potassium	ICP	7.03E+03	1	0	2.72E+04	μg/mL
Samarium[1]	ICP	<3.14E+01	N/A	N/A	N/A	μg/mL
Silicon	ICP	1.00E+02	1	0	2.62E+02	μg/mL
Silver	ICP	7.18	1	0	2.74E+01	μg/mL
Sodium	ICP	9.91E+04	1	0	3.80E+05	μg/mL
Specific gravity	SpG	1.25	N/A	N/A	N/A	unitless
Strontium[1]	ICP	<3.14	N/A	N/A	N/A	μg/mL
Sulfate[1]	IC	7.58E+02	1	0	2.41E+03	μg/mL
Sulfur	ICP	5.20E+02	1	0	1.67E+03	μg/mL
Thallium[1]	ICP	<6.28E+01	N/A	N/A	N/A	μg/mL
Titanium[1]	ICP	<3.14	N/A	N/A	N/A	μg/mL
Total alpha[1]	Alpha rad	<4.73E-03	N/A	N/A	N/A	μCi/mL
Total inorganic carbon	Persulfate oxidation	6.90E+03	1	0	3.90E+04	μg/mL

Table B3-10. Tank 241-AW-104 95 Percent Two-Sided Confidence Interval for the Mean Concentration for Liquid Subdivision Data. (3 sheets)

Analyte	Method	Mean	df	LL	UL	Units
Total organic Carbon	Persulfate Oxidation	3.84E+03	1	0	1.06E+04	µg/mL
Uranium[1]	ICP	<1.57E+02	N/A	N/A	N/A	µg/mL
Vanadium[1]	ICP	<1.57E+01	N/A	N/A	N/A	µg/mL
Zinc[1]	ICP	4.25	1	0	1.47E+01	µg/mL
Zirconium[1]	ICP	<4.25	N/A	N/A	N/A	µg/mL

Note:
[1]A "less than" value was used in the calculation.

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APPENDIX C

STATISTICAL ANALYSIS FOR ISSUE RESOLUTION

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APPENDIX C

STATISTICAL ANALYSIS FOR ISSUE RESOLUTION

Appendix C documents the results of the analyses and statistical and numerical manipulations required by the DQOs applicable for tank 241-AW-104. The analyses required for tank 241-AW-104 are reported as follows:

- **Section C1.0**. Statistical analysis and numerical manipulations of 1997 core sampling data (Steen 1997) supporting the safety screening DQO (Dukelow et al. 1995).

- **Section C2.0**. References for Appendix C.

C1.0 STATISTICS FOR THE SAFETY SCREENING DATA QUALITY OBJECTIVE

The safety screening DQO (Dukelow et al. 1995) defines decision limits in terms of one-sided 95 percent confidence intervals. The safety screening DQO limits for gross alpha are 36.4 μCi/g for the solids and 61.5 μCi/mL for drainable liquid, while the threshold for DSC is 480 J/g (dry weight). Confidence intervals were calculated for the mean values from each laboratory sample. Table C1-1 presents the total alpha results. The DSC results are presented in Table C1-2.

The upper limit (UL) of a one-sided 95 percent confidence interval on the mean is

$$\hat{\mu} + t_{(df,0.05)} \hat{\sigma}_{\hat{\mu}}.$$

In this equation, $\hat{\mu}$ is the arithmetic mean of the data, $\hat{\sigma}_{\hat{\mu}}$ is the estimate of the standard deviation of the mean, and $t_{(df,0.05)}$ is the quantile from Student's t distribution with *df* degrees of freedom. The degrees of freedom equals the number of samples minus one.

For sample numbers with at least one value above the detection limit, the upper limit of a 95 percent confidence interval is given in Table C1-1. Each confidence interval can be used to make the following statement. If the upper limit is less than 36.4 μCi/g (61.5 μCi/mL for drainable liquid), one would reject the null hypothesis that the alpha is greater than or equal to 36.4 μCi/g (61.5 μCi/mL for drainable liquid) at the 0.05 level of significance.

For total alpha activity, 29 of the 46 results were above the detection limit. The UL closest to the threshold was 4.86 μCi/g for core 206, segment 19, lower half. This is well below the limit of 36.4 μCi/g, therefore, criticality is not considered an issue for this tank.

Table C1-1. 95 Percent Upper Confidence Limits for Total Alpha Activity. (2 sheets)

Lab Sample ID	Description	$\hat{\mu}$	df	UL	Units
S97T001512[1]	Core 204, segment 16, drainable liquid	3.58E-04	1	4.46E-04	μCi/mL
S97T001523F	Core 204, segment 18, lower half	1.42E+00	1	1.64E+00	μCi/g
S97T001570F	Core 204, segment 19, lower half	3.39E+00	1	3.96E+00	μCi/g
S97T001598F	Core 204, segment 21, lower half	1.60E-01	1	1.89E-01	μCi/g
S97T001599F	Core 204, segment 22, lower half	2.61E-02	1	4.38E-02	μCi/g
S97T001607[1]	Core 206, segment 15, drainable liquid	3.08E-04	1	3.49E-04	μCi/mL
S97T001608[1]	Core 206, segment 16, drainable liquid	7.53E-04	1	7.53E-04	μCi/mL
S97T001609[1]	Core 206, segment 17, drainable liquid	1.48E-03	1	2.45E-03	μCi/mL
S97T001610	Core 206, segment 18, drainable liquid	2.89E-03	1	2.89E-03	μCi/mL
S97T001616F	Core 206, segment 18, lower half	1.78E+00	1	2.57E+00	μCi/g
S97T001639	Core 206, segment 19, drainable liquid	6.80E-03	1	1.22E-02	μCi/mL
S97T001640[1]	Core 206, segment 20, drainable liquid	1.53E-02	1	4.43E-02	μCi/mL
S97T001641	Core 206, segment 21, drainable liquid	7.89E-03	1	3.32E-02	μCi/mL
S97T001665F	Core 206, segment 19, lower half	4.42E+00	1	4.86E+00	μCi/g
S97T001666F	Core 206, segment 20, lower half	1.76E-01	1	3.69E-01	μCi/g

Table C1-1. 95 Percent Upper Confidence Limits for Total Alpha Activity. (2 sheets)

Lab Sample ID	Description	$\hat{\mu}$	df	UL	Units
S97T001667F	Core 206, segment 21, lower half	1.40E-01	1	2.60E-01	μCi/g
S97T001668F	Core 206, segment 22, lower half	4.25E-02	1	7.34E-02	μCi/g

Note:
[1]A "less than" value was used in the calculations.

Five samples (two solids and three drainable liquid) displayed exothermic behavior. Triplicates were run for two of the samples. For each lab sample identification number, a 95 percent upper confidence limit is given in Table C1-2. All of the results are expressed on a dry-weight basis. Each confidence interval can be used to make the following statement: if the upper limit is less than 480 J/g dry weight, one would reject the null hypothesis that DSC is greater than or equal to 480 J/g at the 0.05 level of significance. The maximum upper limit to a 95 percent confidence interval on the mean for DSC was 125 J/g dry weight (core 206, segment 21, drainable liquid), well below the threshold limit of 480 J/g, thus, energetic reactions are not a concern.

Table C1-2. 95 Percent Upper Confidence Limits for DSC.

Lab Sample ID	Description	$\hat{\mu}$	df	UL	Units
S97T001587	Core 204, segment 20, drainable liquid	5.79E+01	2	9.23E+01	J/g DW
S97T001588	Core 204, segment 22, drainable liquid	5.31E+01	1	6.53E+01	J/g DW
S97T001641	Core 206, segment 21, drainable liquid	8.05E+01	2	1.25E+02	J/g DW
S97T001646	Core 206, segment 21, upper half	8.97E+01	1	1.02E+02	J/g DW
S97T001651	Core 206, segment 22, lower half	7.12E+01	1	8.11E+01	J/g DW

C2.0 APPENDIX C REFERENCES

Dukelow, G. T., J. W. Hunt, H. Babad, and J. E Meacham, 1995, *Tank Safety Screening Data Quality Objective*, WHC-SD-WM-SP-004, Rev. 2, Westinghouse Hanford Company, Richland, Washington.

Steen, F. H., 1997, Tank 241-AW-104, *Cores 204 and 206 Analytical Results for the Final Report*, HNF-SD-WM-DP-264, Rev. 0, Waste Management of Hanford, Inc., Richland, Washington.

APPENDIX D

EVALUATION TO ESTABLISH BEST-BASIS INVENTORY FOR DOUBLE-SHELL TANK 241-AW-104

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APPENDIX D

EVALUATION TO ESTABLISH BEST-BASIS INVENTORY FOR DOUBLE-SHELL TANK 241-AW-104

An effort is under way to provide waste inventory estimates that will serve as standard characterization source terms for the various waste management activities (Hodgson and LeClair 1996). As part of this effort, available information for double-shell tank 241-AW-104 was evaluated and a best-basis inventory was established. This work, detailed in the following sections, follows the methodology that was established by the standard inventory task.

D1.0 CHEMICAL INFORMATION SOURCES

Available waste (chemical) information for tank 241-AW-104 includes the following:

- Analytical data from two core samples obtained in 1997 (Steen 1997) and two supernatant and one sludge grab sample obtained in September 1994 (Rollison 1995).
- Statistical analysis of the analytical data from the two 1997 core samples and core sample profiles from the 1997 sampling event found in Appendix B, Section B3.4.
- Analytical data from *242-A Evaporator/Crystallizer Fiscal Year 1985 Campaign Run 85-1 Post-Run Document* (Pontious 1985).
- Inventory estimates generated from the HDW model (Agnew et al. 1997a).

D2.0 COMPARISON OF COMPONENT INVENTORY VALUES

Tank 241-AW-104 chemical and radionuclide inventories predicted from the HDW model and previous best-basis estimates are shown in Tables D2-1 and D2-2, respectively. Following the best-basis inventory convention, the chemical species are reported without charge designation. Radionuclide inventories are decayed to January 1, 1994, to be consistent with the decay date used in the HDW model. The HDW model and previous best-basis inventory estimates are based on a total waste volumes of 4,239 kL (1,120 kgal) and 4,235 kL (1,119 kgal), respectively.

Table D2-1. Hanford Defined Waste and Previous Best-Basis Inventory Estimates for Nonradioactive Components in Tank 241-AW-104. (2 sheets)

Analyte	HDW Inventory Estimate[1] (kg)	Previous Best-Basis Inventory Estimate[2] (kg)
Al	75.5	59,700
Bi	0.422	0
Ca	8,190	3,670
Cl	554	11,200
Cr	1,620	2,680
F	1,910	34,400
Fe	40,200	6,430
Hg	7.97	0
K	1,190	11,500
La	0.00397	0
Mn	1,280	2,100
Na	60,000	5.42E+05
Ni	2,810	2,810
NO_2	1,960	2.04E+05
NO_3	62,600	3.29+05
OH	43,700	3.19E+05
Pb	35.3	2,800
PO_4	25,600	4,350
Si	3.88	2,350
SO_4	1,550	17,500
Sr	0	0.005
TIC as CO_3	36,000	20,500

Table D2-1. Hanford Defined Waste and Previous Best-Basis Inventory Estimates for Nonradioactive Components in Tank 241-AW-104. (2 sheets)

Analyte	HDW Inventory Estimate[1] (kg)	Previous Best-Basis Inventory Estimate[2] (kg)
TOC	1,940	2,750
U_{TOTAL}	8,500	23,700
Zr	1,600	1,100

Notes:

HDW = Hanford Defined Waste

[1]Agnew et al. (1997a)
[2]LMHC (1998)

Table D2-2. Hanford Defined Waste and Previous Best-Basis Inventory Estimates for Radioactive Components in Tank 241-AW-104. (3 sheets)

Analyte	HDW Inventory Estimate[1] (Ci)	Previous Best-Basis Estimate[2] (Ci)
^{3}H	0.741	0.741
^{14}C	0.0607	0.0607
^{59}Ni	0.00582	0.00582
^{60}Co	0.138	0.138
^{63}Ni	0.618	0.618
^{79}Se	0.00687	0.00687
^{90}Sr	282	1,270
^{90}Y	282	1,270
^{93}Zr	0.0334	0.0334
^{93m}Nb	0.0236	0.0236
^{99}Tc	0.443	179
^{106}Ru	9.78	9.78
^{113m}Cd	0.188	0.188
^{125}Sb	1.96	1.96
^{126}Sn	0.0105	0.0105
^{129}I	8.57E-04	8.57E-04
^{134}Cs	0.749	0.749

Table D2-2. Hanford Defined Waste and Previous Best-Basis Inventory Estimates for Radioactive Components in Tank 241-AW-104. (3 sheets)

Analyte	HDW Inventory Estimate[1] (Ci)	Previous Best-Basis Estimate[2] (Ci)
^{137}Cs	518	2.75E+05
^{137m}Ba	490	2.60E+05
^{151}Sm	24.2	24.2
^{152}Eu	0.0279	0.0279
^{154}Eu	1.66	1.66
^{155}Eu	4.10	4.1
^{226}Ra	2.67E-07	2.67E-07
^{227}Ac	1.66E-06	1.66E-06
^{228}Ra	5.71E-04	5.71E-04
^{229}Th	1.33E-05	1.33E-05
^{231}Pa	7.39E-06	7.39E-06
^{232}Th	5.84E-05	5.84E-05
^{232}U	0.00276	0.00769
^{233}U	0.00707	0.0197
^{234}U	4.12	11.5
^{235}U	0.157	0.437
^{236}U	0.339	0.946
^{237}Np	0.00176	0.00176
^{238}Pu	109	109
^{238}U	2.83	7.89
^{239}Pu	882	882
^{240}Pu	268	268
^{241}Am	0.450	0.450
^{241}Pu	11,100	11,100
^{242}Cm	0.00204	0.00204
^{242}Pu	0.0415	0.0415
^{243}Am	7.53E-05	7.53E-05

Table D2-2. Hanford Defined Waste and Previous Best-Basis Inventory Estimates for Radioactive Components in Tank 241-AW-104. (3 sheets)

Analyte	HDW Inventory Estimate[1] (Ci)	Previous Best-Basis Estimate[2] (Ci)
^{243}Cm	3.22E-04	0.000322
^{244}Cm	0.00154	0.00154

Notes:

HDW = Hanford Defined Waste

[1]Agnew et al. (1997a), decayed to January 1, 1994.
[2]LMHC (1998), decayed to January 1, 1994.

D3.0 COMPONENT INVENTORY EVALUATION

The following evaluation was conducted to assess various estimates of tank contents.

D3.1 WASTE HISTORY TANK 241-AW-104

Tank 241-AW-104 went into service in 1980. From 1980 through the third quarter of 1984 this tank received PUREX miscellaneous and decladding waste, dilute noncomplexed waste, water, and double-shell slurry feed (DSSF) from the 242-A Evaporator. According to Agnew et al. (1997b), little solids accumulated in the tank through this period. In the fourth quarter of 1984, the tank received 3,634 kL (960 kgal) of a concentrated DSSF. A substantial increase in the solids volume was observed in the first quarter of 1985. These solids remained in the tank when the DSSF was pumped out during the second quarter of 1986, and exist in the tank today.

From 1986 through 1992, tank 241-AW-104 received dilute PUREX waste and water. Agnew et al. (1997b) predicts that a small amount of PUREX solids has been deposited in the tank. Since 1992, transfers in and out of the tank have been minimal. For a more complete history of the waste in this tank refer to Appendix A, Section A3.0 and Agnew et al. (1997b).

D3.2 CONTRIBUTING WASTE TYPES

Agnew et al. (1997a) identifies the waste in the tank as 3,861 kL (1,020 kgal) of supernatant mixing model (SMM) composite and 390 kL (103 kgal) of tank layer model (TLM) solids composite. The SMM composite includes 708 kL (187 kgal) of SMMA saltcake and 3,153 kL

(833 kgal) of liquids. Agnew et al. (1997a) reports the composition of the TLM solids to be 18.9 kL (5 kgal) of PUREX zirconium-cladding waste and 371 kL (98 kgal) of PUREX low-level waste. In this best-basis evaluation, the TLM solids composite is assumed to be "sludge."

Hanlon (1998) lists the tank as containing 3,361 kL (888 kgal) of supernatant liquid, 590 kL (156 kgal) of sludge, and 284 kL (75 kgal) of saltcake, totaling 4,235 kL (1,119 kgal) of waste.

The evaporator campaign report from evaporator run 85-1 indicates that 3,540 kl (935 kgal) of concentrated waste were added to tank 241-AW-104. This slurry contained approximately 18 percent solids based on filtration measurements. This volume is equivalent to a minimum volume of 637 kl (168 kgal) of solids in tank 241-AW-104.

D3.3 ASSESSMENT OF AVAILABLE INFORMATION

The general best-basis approach is to use all available information to formulate a set of component inventory estimates that would best represent the current tank contents. The sources of information may include analytical data from samples taken from the tank of interest, analytical data from other tanks believed to contain waste types similar to those believed to be in the tank of interest, and/or data from models based on historical process records. The confidence level assigned to the best-basis inventory values depends on the level of agreement among the information sources.

Four sources of information can potentially be used to develop the best-basis inventory estimates for tank 241-AW-104. First, the 1997 core samples (cores 204 and 206) provide analytical data for most chemical components. Some analytical data also were used from the grab samples taken in 1994. Post-run documents from 242-A Evaporator operations provided addition information on the composition of the slurry feed materials that were the source of much of the saltcake layer in tank 241-AW-104. The final source is the HDW model results reported in Agnew et al. (1997a).

D3.4 TANK 241-AW-104 ENGINEERING-BASED INVENTORY ESTIMATES

In this engineering assessment, it is assumed that the solids layer in tank 241-AW-104 could be approximated by combining the TLM solids inventory estimates (i.e., sludge) from Agnew et al. (1997a) with estimates for the saltcake that separated from the DSSF. Saltcake inventory estimates are based on analytical data from the evaporator post-run document (Pontious 1985). The assumption is that the saltcake originating from the DSSF is similar in composition to the original DSSF.

Most of the solids in tank 241-AW-104 can be traced to DSSF produced during 242-A Evaporator run 85-1 in the fourth quarter of 1984. This DSSF was stored in tank 241-AW-104 for about 18 months. These solids are thought to have remained when the DSSF was pumped out of the tank. This solids layer has remained relatively constant even though large quantities of dilute PUREX low-level waste have been pumped through the tank since the solids layer formed.

Slurry samples were taken during the 85-1 evaporator run (Pontious 1985). The slurry samples were reported to have contained from 15 to 20 volume percent solids. The compositions of the DSSF for the 85-1 evaporator run are listed in Table D3-1, which also includes inventory estimates for the solids that were assumed to have come from the DSSF.

Solids inventory estimates in Table D3-1 were derived using a total solids volume of 1,100 kL (290 kgal) that combines 708 kL (187 kgal) of SMMA saltcake (based on DSSF composition) with 390 kL (103 kgal) of TLM solids. This solids volume from Agnew et al. (1997a) is larger than the Hanlon (1998) solids volume of 874 kL [231 kgal] (sludge and saltcake).

Table D3-1. Engineering-Based Solids Inventory Estimates for Tank 241-AW-104. (2 sheets)

Analyte	DSSF Composition[1]	DSSF Solids Inventory Estimate[2]	TLM Solids Inventory Estimate[3]	Engineering-Based Solids Inventory Estimate[4]
	μg/mL	kg	kg	kg
Al	37,000	26,200	0.00	26,200
Fe	n/r	n/r	39,800	39,800
Na	2.12E+05	1.50E+05	7,250	1.5725E+05
K	16,000	11,300	230	11,530
Cl	5,680	4,020	48.4	4,070
F	2,660	1,880	1,900	3,780
OH	51,800	36,700	41,200	77,900
NO_3	1.45E+05	1.03E+05	5,650	1.0865E+05
NO_2	1.06E+05	75,000	160	75,160
PO_4	2,800	1,980	2,180	4,160
SO_4	n/r	n/r	128	128
CO_3	11,400	8,070	12,400	20,470
Density	1.41	1.41	1.21	NA

Table D3-1. Engineering-Based Solids Inventory Estimates for Tank 241-AW-104. (2 sheets)

Analyte	DSSF Composition[1]	DSSF Solids Inventory Estimate[2]	TLM Solids Inventory Estimate[3]	Engineering-Based Solids Inventory Estimate[4]
Radionuclides[5]	μCi/mL	Ci	Ci	Ci
^{90}Sr	1.65	1,160	79.7	1,240
^{99}Tc	0.253	179	0.017	179
^{137}Cs	368	2.61E+05	94.1	2.611E+05

Notes:

DSSF = Double-shell slurry feed
n/r = Not reported
TLM = Tank layer model

[1]Pontious (1985)

[2]Solids volume = 708 kL (187 kgal) of SMMA saltcake.

[3]Agnew et al. (1997a) based on 390 kL (103 kgal) of TLM solids.

[4]Used sum of DSSF solids inventory plus TLM solids inventory to represent total solids inventory of 1,100 kL (290 kgal).

[5]Radionuclides decayed to January 1, 1994.

D3.5 ESTIMATED COMPONENT INVENTORIES FOR TANK 241-AW-104

D3.5.1 Sample-Based Solids Inventory Estimates

Two full-depth core samples were obtained from tank 241-AW-104 in June 1997. Core 204 taken from riser 13A consisted of eight complete 48 cm (19-in.) long segments. Core recoveries varied from a low of 35 percent for the second highest segment in the solids layer (segment 20) to as much as 93 percent for the three uppermost segments in the supernatant (segments 15, 16, 17). Segments 1 through 14 were not taken in the supernatant layer. Similar results were obtained for core 206, except the lowest recovery was 63 percent for the bottom segment in the solids layer (segment 22). Core 206 was taken from riser 15A.

Based on an average drainable liquid volume for segment 18 from cores 204 and 206 of 170 mL, the total solids volume for the tank is calculated to be 885 kL (234 kgal). This is in excellent agreement with the Hanlon (1998) solids volume (sludge + saltcake) of 874 kL (231 kgal). The mean solid density of 1.471 g/mL is obtained by first averaging cores 204 and 206 density values by segment and then averaging the segment averages. The analytical solids concentrations from each segment and subsegment were statistically analyzed to determine mean analytical solids concentrations. Less than values were assigned to those analytes where more than half the results were found to be below the detection limit for that analyte. The solids inventory is calculated by multiplying the mean analytical solids concentrations by the Hanlon (1998) solids volume of 874 kL (231 kgal) and by the solids mean density of 1.471 g/mL. The solids mean analytical concentrations and the resulting sample-based solids inventory estimates are given in Table D3-2.

Table D3-2. Tank 241-AW-104 Solids Concentrations and Sample-Based Solids Inventory Estimates. (2 sheets)

Analyte	Solids Mean Concentration[1] (μg/g)	Sample-Based Solids Inventory[2] (kg)
Ag	<214	<276
Al	16,000	20,600
As	<2,140	<2,760
B	<1,070	<1,380
Ba	<1,070	<1,380
Be	107	<138
Bi	<2,140	<2,760
Br	<587	<754
Ca	<2,840	<3,650
Cd	<114	<146
Ce	<2,140	<2,760
Cl	2,380	3,060
Co	<429	<551
Cr	2,050	2,630
Cu	<214	<276
F	25,500	32,800
Fe	5,070	6,520
La	<1,070	<1,380
Li	<214	<276
Mg	<2,140	<2,760
Mn	1,660	2,130
Mo	<1,070	<1,380

Table D3-2. Tank 241-AW-104 Solids Concentrations and Sample-Based Solids Inventory Estimates. (2 sheets)

Analyte	Solids Mean Concentration[1] (μg/g)	Sample-Based Solids Inventory[2] (kg)
Na	1.66E+05	2.14E+05
Nd	<2,140	<2,760
NO_2	43,400	55,700
NO_3	65,600	84,300
Oxalate	6,820	8,770
P	<4,430	<5,690
Pb	<2,140	<2,760
PO_4	2,170	2,780
S	5,330	6,860
Sb	<1,320	<1,690
Si	1,600	2,060
Sm	<2,140	<2,760
SO_4	11,900	15,300
Sr	<214	<276
Ti	<214	<276
Tl	<4,290	<5,510
TIC (as CO_3)	47,600	61,200
TOC	6,170	7,930
U	<18,400	<23,700
V	<1,070	<1,380
Zn	<291	<374
Zr	872	1,120
Radionuclides	**μCi/g**	**Ci**
Total alpha	1.28	1,650

Notes:

[1]Based on 1997 core samples.

[2]Used a solids volume of 874 kL (231 kgal) and a mean solids density of 1.471 g/mL.

D3.5.2 Sample-Based Supernatant Inventory Estimates

Based on the manual ENRAF™ waste surface level reading of 1,033 cm (406.86 cm), taken on May 31, 1998, the total waste volume for the tank is calculated to be 4,255 kL (1,124 kgal). The supernatant volume, calculated by subtracting the solids volume from the total waste volume, is 3,370 kL (890 kgal). This is in excellent agreement with the Hanlon (1998) supernatant volume of 3,361 kL (888 kgal). The analytical drainable liquid concentrations from each segment and subsegment were statistically analyzed to determine mean analytical drainable liquid concentrations. Less than values were assigned to those analytes where more than half the results were found to be below the detection limit for that analyte. The liquid inventory is calculated by multiplying the mean analytical drainable liquid concentrations by the Hanlon (1998) supernatant volume of 3,361 kL (888 kgal). The mean analytical drainable liquid concentrations and the resulting sample-based supernatant inventory estimates are given in Table D3-3.

Table D3-3. Tank 241-AW-104 Drainable Liquid Concentrations and Sample-Based Liquid Inventory Estimates. (3 sheets)

Analyte	Drainable Liquid Mean Concentration[1]	Sample-Based Supernatant Inventory[2]
	(μg/mL)	(kg)
Ag	7.18	24.1
Al	11,800	39,500
As	<31.4	<106
B	21.3	71.5
Ba	<15.7	<52.9
Be	<1.57	<5.28
Bi	<31.4	<106
Br	<391	<1,320
Ca	<31.4	<106
Cd	<1.77	<5.95
Ce	<31.4	<106
Cl	2,440	8,190
Co	<6.28	<21.1
Cr	31.6	106
Cu	<3.16	<10.6
F	707	2,370
Fe	<15.7	<52.9

Table D3-3. Tank 241-AW-104 Drainable Liquid Concentrations and Sample-Based Liquid Inventory Estimates. (3 sheets)

Analyte	Drainable Liquid Mean Concentration[1]	Sample-Based Supernatant Inventory[2]
	(μg/mL)	(kg)
K	7,030	23,600
La	<15.7	<52.9
Li	<3.14	<10.6
Mg	<31.4	<106
Mn	<3.65	<12.3
Mo	29.3	98.4
Na	99,100	3.33E+05
Nd	<31.4	<106
Ni	<6.31	<21.2
NO_2	44,400	1.49E+05
NO_3	73,200	2.46E+05
Oxalate	<456	<1,530
P	338	1,140
Pb	<31.4	<106
PO_4	485	1,630
S	520	1,750
Sb	<18.9	<63.4
Si	100	337
Sm	<31.4	<106
SO_4	758	2,550
Sr	<3.14	<10.6
Ti	<3.14	<10.6
Tl	<62.8	<211
TIC (as CO_3)	34,500	1.16E+05
TOC	3,840	12,900
U	<157	<527
V	<15.7	<52.9
Zn	4.25	14.3
Zr	<4.25	<14.3

Table D3-3. Tank 241-AW-104 Drainable Liquid Concentrations and Sample-Based Liquid Inventory Estimates. (3 sheets)

Analyte	Drainable Liquid Mean Concentration[1]	Sample-Based Supernatant Inventory[2]
Radionuclides	μCi/mL	Ci
Total alpha	<0.00473	<15.9
^{90}Sr	0.00779[3]	26.2
^{134}Cs	0.00876[3]	29.4
^{137}Cs	4.54[3]	15,300
$^{239/240}Pu$	1.63E-05[3]	0.0548
^{241}Am	<4.72E-04[3]	<1.59

Notes:

[1]Based on 1997 core samples.

[2]Used a supernatant volume of 3,361 kgal (888 kgal).

[3]Based on 1994 grab samples.

D3.5.3 Sample-Based Total Inventory Estimates

Sample-based total inventory estimates, shown in Table D3-4, are calculated by summing the sample-based solids inventory estimates from Table D3-2 and the sample-based supernatant inventory estimates from Table D3-3. The engineering-based and HDW model-based inventory estimates are shown for comparison.

Table D3-4. Tank 241-AW-104 Total Inventory Estimates. (3 sheets)

Analyte	Sample-Based Inventory[1]			Engineering-Based Inventory (kg)	HDW Inventory (kg)
	Solids (kg)	Supernatant (kg)	Total (kg)		
Ag	<276	24.1	<300	N/A	n/r
Al	20,600	39,500	60,100	26,200	75.5
As	<2,760	<106	<2,860	N/A	n/r
B	<1,380	71.5	<1,450	N/A	n/r
Ba	<1,380	<52.9	<1,430	N/A	n/r
Be	<138	<5.28	<143	N/A	n/r

Table D3-4. Tank 241-AW-104 Total Inventory Estimates. (3 sheets)

Analyte	Sample-Based Inventory[1] Solids (kg)	Sample-Based Inventory[1] Supernatant (kg)	Sample-Based Inventory[1] Total (kg)	Engineering-Based Inventory (kg)	HDW Inventory (kg)
Bi	<2760	<106	<2,860	N/A	0.422
Br	<754	<1,320	<2,070	N/A	n/r
Ca	<3,650	<106	<3,760	N/A	8,190
Cd	<146	<5.95	<152	N/A	n/r
Ce	<2,760	<106	<2,860	N/A	n/r
Cl	3,060	8,190	11,300	4,070	554
Co	<551	<21.1	<572	N/A	n/r
Cr	2,630	106	2,740	N/A	1,620
Cu	<276	<10.6	<286	N/A	n/r
F	32,800	2,370	35,200	3,780	1,910
Fe	6,520	<52.9	<6,580	39,800	40,200
K	NA	23,600	n/a	11,500	1,190
La	<1,380	<52.9	<1,430	N/A	0.00397
Li	<276	<10.6	<286	N/A	n/r
Mg	<2,760	<106	<2,860	N/A	n/r
Mn	2,130	<12.3	<2,150	N/A	1,280
Mo	<1,380	98.4	<1,480	N/A	n/r
Na	2.14E+05	3.33E+05	5.47E+05	1.57E+05	60,000
Nd	<2,760	<106	<2,860	N/A	n/r
Ni	NA	<21.2	n/a	N/A	2,810
NO_2	55,700	1.49E+05	2.05E+05	75,200	1,960
NO_3	84,300	2.46E+05	3.30E+05	1.09E+05	62,600
Oxalate	8,770	<1,530	<10,300	N/A	0.00329
P	<5,690	1,140	<6,830	N/A	n/r
Pb	<2,760	<106	<2,860	N/A	35.3
PO_4	2,780	1,630	4,420	4,160	25,600
S	6,860	1,750	8,600	N/A	n/r
Sb	<1,690	<63.4	<1,750	N/A	n/r
Si	2,060	337	2,400	N/A	3.88
Sm	<2,760	<106	<2,860	N/A	n/r

Table D3-4. Tank 241-AW-104 Total Inventory Estimates. (3 sheets)

Analyte	Sample-Based Inventory[1] Solids (kg)	Supernatant (kg)	Total (kg)	Engineering-Based Inventory (kg)	HDW Inventory (kg)
SO_4	15,300	2,550	17,900	128	1,550
Sr	<276	<10.6	<286	N/A	0
Ti	<276	<10.6	<286	N/A	n/r
Tl	<5,510	<211	<5,720	N/A	n/r
TIC (as CO_3)	61,200	1.16E+05	1.77E+05	20,500	36,000
TOC	7,930	12,900	20,900	N/A	1,940
U	<23,700	<527	<24,200	N/A	8,500
V	<1,380	<52.9	<1,430	N/A	n/r
Zn	<374	14.3	<389	N/A	n/r
Zr	1,120	<14.3	<1,140	N/A	1,600
Radionuclides	**Ci**	**Ci**	**Ci**	**Ci**	**Ci**
Total alpha	1,650	<15.9	<1,670	N/A	n/r
^{90}Sr	N/A	26.2[2]	n/a	1,240	282
^{134}Cs	N/A	29.4[2]	n/a	N/A	0.749
^{137}Cs	N/A	15,300[2]	n/a	2.61E+05	518
$^{239/240}Pu$	N/A	0.0548[2]	n/a	N/A	1,150
^{241}Am	N/A	<1.59[2]	n/a	N/A	0.450

Notes:
- N/A = not available
- n/a = not applicable
- n/r = not reported

[1]Based on 1997 core samples.
[2]Based on 1994 grab samples.

D3.5.4 Estimated Radionuclide Inventory Estimates

The core samples from tank 241-AW-104 were not analyzed for individual radionuclides. In addition, results for only several radionuclides, shown in Table D3-3, were obtained from the 1994 grab samples. In this section, inventories for several radionuclides are reestimated using different data sources.

Uranium isotopes are estimated using the sample-based total uranium inventory of 24,200 kg from Table D3-4 and the isotopic ratios from the HDW estimate for tank 241-AW-104. Although the total uranium sample-based value is a non-detect value, it is taken as an upper bound estimate. The calculation of the uranium inventories is provided in Table D3-5.

Table D3-5. Uranium Isotopes Inventory Calculation for Tank 241-AW-104.

	Specific Activity (Ci/g)	HDW Model Values[1]		Adjusted Values[2]	
		(kg)	(Ci)	(kg)	(Ci)
^{232}U	21.40	1.29E-07	0.00276	3.67E-07	0.00786
^{233}U	0.009680	7.30E-04	0.00707	0.00208	0.0201
^{234}U	0.006249	0.660	4.12	1.88	11.8
^{235}U	2.162E-06	72.5	0.157	207	0.447
^{236}U	6.470E-05	5.25	0.339	15.0	0.968
^{238}U	3.362E-07	8,420	2.83	24,000	8.07
Total	n/a	8,500	7.46	24,200	21.3

Notes:

HDW = Hanford Defined Waste

[1]Agnew et al. (1997a)

[2]U_{TOTAL} (in kg) value from Table D3-4. Other uranium isotope data are calculated by ratio from HDW values.

Plutonium, americium, and curium isotopes are considered to be significant alpha contributors, and are calculated by ratio from HDW values using the analytical results for total alpha activity. The sample-based total alpha activity for the tank from Table D3-4 is 1,670 Ci. Table D3-6 shows how plutonium, americium, and curium isotope inventories are calculated. Subtracting the inventory for all uranium isotopes (Table D3-5) from the inventory for all alpha-emitting radionuclides yields an estimate for the net alpha inventory. Inventories for the non-uranium alpha contributors can be calculated by ratio from the HDW isotopic values. Finally, ^{241}Pu (not an alpha emitter) can be calculated from the HDW estimate using the ratio to another plutonium isotope (^{239}Pu is used).

Table D3-6. Inventory Calculation for Non-Uranium Alpha Contributors for Tank 241-AW-104.

Alpha Contributor	HDW Model Inventory[1] (Ci)	Adjusted Inventory[2] (Ci)
U_{TOTAL}	7.46	21.3
Total alpha	1,270	1,670
Net alpha (Non-uranium)	1,260	1,650
^{238}Pu	109	142
^{239}Pu	882	1,150
^{240}Pu	268	350
^{241}Pu[3]	11,100	14,500
^{242}Pu	0.0415	0.0542
^{241}Am	0.450	0.588
^{243}Am	7.53E-05	9.83E-05
^{242}Cm	0.00204	0.00267
^{243}Cm	3.22E-04	4.20E-04
^{244}Cm	0.00153	0.00202

Notes:
HDW = Hanford Defined Waste

[1]Agnew et al. (1997a)
[2]The adjusted inventory was calculated by ratio from HDW values.
[3]Not an alpha emitter. The calculation was based on the HDW ratio of ^{241}Pu to ^{239}Pu.

The adjusted radionuclide inventories calculated in this section, the engineering-based ^{90}Sr and ^{137}Cs inventories from Table D3-4, and unmodified HDW model inventories for the remainder of the radionuclides are used as the best-basis estimates.

D4.0 DEFINE THE BEST-BASIS AND ESTABLISH COMPONENT INVENTORIES

Information about chemical, radiological, and/or physical properties is used to perform safety analyses, engineering evaluations, and risk assessments associated with waste management activities, as well as regulatory issues. These activities include overseeing tank farm operations and identifying, monitoring, and resolving safety issues associated with these operations and with the tank waste. Disposal activities involve designing equipment, processes, and facilities for retrieving waste and processing it into a form suitable for long-term storage or disposal.

Chemical and radiological inventory information is generally derived using one of three approaches: 1) component inventories are estimated using the results of sample analyses, 2) component inventories are estimated using the HDW model based on process knowledge and historical information, or 3) a tank-specific process estimate is made based on process flowsheets, reactor fuel data, essential material use, and other operating data. The information derived from these different approaches is often inconsistent.

An effort is under way to provide waste inventory estimates that will serve as standard characterization source terms for the various waste management activities (Hodgson and LeClair 1996). As part of this effort, available information about tank 241-AW-104 was evaluated and a best-basis inventory was established. The following information was used as part of this evaluation:

- Analytical data from two core samples obtained in 1997 (Steen 1997) and two supernatant and one sludge grab sample obtained in September 1994 (Rollison 1995).

- Statistical analysis of the analytical data from the two 1997 core samples and core sample profiles from the 1997 sampling event.

- Analytical data from *242-A Evaporator/Crystallizer Fiscal Year 1985 Campaign Run 85-1 Post-Run Document* (Pontious 1985).

- Inventory estimates generated from the HDW model (Agnew et al. 1997a).

Once the best-basis inventories were determined, the hydroxide inventory was calculated by performing a charge balance with the valences of other analytes. The charge balance approach is consistent with that used in Agnew et al. (1997a).

The best-basis inventory for tank 241-AW-104 is presented in Tables D4-1 and D4-2. The inventory estimates for most of the chemical components are based on sample results. For other chemicals, inventory results are based on a combination of sample results, an engineering assessment, and/or HDW model results. Where no sampling or engineering estimate exists, the HDW model results were used. Finally, inventories for a few components are revised based on process knowledge. The inventory values reported in Tables D4-1 and D4-2 are subject to change. Refer to the Tank Characterization Database for the most current inventory values.

Best-basis tank inventory values are derived for 46 key radionuclides (as defined in Section 3.1 of Kupfer et al. 1997). Often, waste sample analyses have only reported ^{90}Sr, ^{137}Cs, $^{239/240}Pu$, and total uranium (or total beta and total alpha), while other key radionuclides such as ^{60}Co, ^{99}Tc, ^{129}I, ^{154}Eu, ^{155}Eu, and ^{241}Am have been infrequently reported. For this reason, most of the 46 key radionuclides had to be derived by computer models. These models estimate radionuclide activity in batches of reactor fuel, account for the split of radionuclides to various separations plant waste streams, and track their movement with tank waste transactions. These computer models are described in Kupfer et al. (1997), Section 6.1 and in Watrous and Wootan (1997). Model-generated values for radionuclides in any of the tanks are reported in the HDW, Rev. 4, model results (Agnew et al. 1997a). The best-basis value for any one analyte may be either a model result or a sample or engineering assessment-based result if available. For a discussion of typical error between model-derived values and sample-derived values, see Kupfer et al. (1997), Section 6.1.10.

Table D4-1. Best-Basis Inventory Estimates for Nonradioactive Components in Tank 241-AW-104 (Effective May 31, 1998). (2 sheets)

Analyte	Total inventory (kg)	Basis (S, M, E, or C)	Comment
Al	60,100	S	
Bi	0	E	Bismuth is relatively insoluble in the supernatants added to this tank.
Ca	3,760	S/E	Upper-bound limit.
Cl	11,300	S	
TIC as CO_3	1.77E+05	S	
Cr	2,740	S	
F	35,200	S	
Fe	6,580	S	
Hg	0	E	Simpson (1998).
K	24,600	S/M	Used TLM solids inventory and sample-based liquid inventory.
La	0	E	No evidence of 224 waste in this tank.
Mn	2,150	S	
Na	5.47E+05	S	
Ni	2,810	M	
NO_2	2.05E+05	S	
NO_3	3.30E+05	S	
OH_{TOTAL}	2.31E+05	C	
Pb	35.3	M	
PO_4	4,420	S	

Table D4-1. Best-Basis Inventory Estimates for Nonradioactive Components in Tank 241-AW-104 (Effective May 31, 1998). (2 sheets)

Analyte	Total inventory (kg)	Basis (S, M, E, or C)	Comment
Si	2,400	S	
SO_4	17,900	S	
Sr	0.0297	E	Assumed ^{90}Sr is 30 percent of total strontium.
TOC	20,900	S	
U_{TOTAL}	24,200	S/E	Upper-bound limit.
Zr	1,140	S/E	

Notes:

S =sample base, M=HDW model-based (Agnew et al. 1997a), E=engineering assessment-based, and C=calculated by charge balance; includes oxides as "hydroxide" not including CO_3, NO_2, NO_3, PO_4, SO_4, and SiO_3..

Table D4-2. Best-Basis Inventory Estimates for Radioactive Components in Tank 241-AW-104, Decayed to January 1, 1994 (Effective May 31, 1998). (3 sheets)

Analyte	Total inventory (Ci)	Basis (S, M, or E)	Comment
^{3}H	0.741	M	
^{14}C	0.0607	M	
^{59}Ni	0.00582	M	
^{60}Co	0.138	M	
^{63}Ni	0.618	M	
^{79}Se	0.00687	M	
^{90}Sr	1,240	E	
^{90}Y	1,240	E	Based on ^{90}Sr data.
^{93}Zr	0.0334	M	
^{93m}Nb	0.0236	M	
^{99}Tc	179	E	
^{106}Ru	9.78	M	
^{113m}Cd	0.188	M	

Table D4-2. Best-Basis Inventory Estimates for Radioactive Components in Tank 241-AW-104, Decayed to January 1, 1994 (Effective May 31, 1998). (3 sheets)

Analyte	Total inventory (Ci)	Basis (S, M, or E)	Comment
^{125}Sb	1.96	M	
^{126}Sn	0.0105	M	
^{129}I	8.57E-04	M	
^{134}Cs	0.749	M	
^{137}Cs	261,000	E	
^{137m}Ba	247,000	E	Referenced to ^{137}Cs.
^{151}Sm	24.2	M	
^{152}Eu	0.0279	M	
^{154}Eu	1.66	M	
^{155}Eu	4.1	M	
^{226}Ra	2.67E-07	M	
^{227}Ac	1.66E-06	M	
^{228}Ra	5.71E-04	M	
^{229}Th	1.33E-05	M	
^{231}Pa	7.39E-06	M	
^{232}Th	5.84E-05	M	
^{232}U	0.00786	S/E/M	Used engineering-based total uranium inventory and HDW isotopic ratios.
^{233}U	0.0201	S/E/M	Used engineering-based total uranium inventory and HDW isotopic ratios.
^{234}U	11.8	S/E/M	Used engineering-based total uranium inventory and HDW isotopic ratios.
^{235}U	0.447	S/E/M	Used engineering-based total uranium inventory and HDW isotopic ratios.
^{236}U	0.968	S/E/M	Used engineering-based total uranium inventory and HDW isotopic ratios.
^{237}Np	0.00176	M	
^{238}Pu	142	S/E/M	Used sample-based net alpha inventory and HDW isotopic ratios.
^{238}U	8.07	S/E/M	Used engineering-based touranium inventory and HDW isotopic ratios.

Table D4-2. Best-Basis Inventory Estimates for Radioactive Components in Tank 241-AW-104, Decayed to January 1, 1994 (Effective May 31, 1998). (3 sheets)

Analyte	Total inventory (Ci)	Basis (S, M, or E)	Comment
^{239}Pu	1,150	S/E/M	Used sample-based net alpha inventory and HDW isotopic ratios.
^{240}Pu	350	S/E/M	Used sample-based net alpha inventory and HDW isotopic ratios.
^{241}Am	0.588	S/E/M	Used sample-based net alpha inventory and HDW isotopic ratios.
^{241}Pu	14,500	S/E/M	Used sample-based net alpha inventory and HDW isotopic ratios.
^{242}Cm	0.00267	S/E/M	Used sample-based net alpha inventory and HDW isotopic ratios.
^{242}Pu	0.0542	S/E/M	Used sample-based net alpha inventory and HDW isotopic ratios.
^{243}Am	9.83E-05	S/E/M	Used sample-based net alpha inventory and HDW isotopic ratios.
^{243}Cm	4.20E-04	S/E/M	Used sample-based net alpha inventory and HDW isotopic ratios.
^{244}Cm	0.00202	S/E/M	Used sample-based net alpha inventory and HDW isotopic ratios.

Notes:

S = sample-based, M = HDW model-based (Agnew et al. 1997a) and E=engineering assessment-based.

D5.0 APPENDIX D REFERENCES

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APPENDIX E

BIBLIOGRAPHY FOR TANK 241-AW-104

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APPENDIX E

BIBLIOGRAPHY FOR TANK 241-AW-104

Appendix E is a bibliography that supports the characterization of tank 241-AW-104. This bibliography represents an in-depth literature search of all known information sources that provide sampling, analysis, surveillance, modeling information, and processing occurrences associated with tank 241-AW-104 and its respective waste types.

The references in this bibliography are separated into three categories containing references broken down into subgroups. These categories and their subgroups are listed below.

I. NON-ANALYTICAL DATA

- Ia. Models/Waste Type Inventories/Campaign Information
- Ib. Fill History/Waste Transfer Records
- Ic. Surveillance/Tank Configuration
- Id. Sample Planning/Tank Prioritization
- Ie. Data Quality Objectives/Customers of Characterization Data

II. ANALYTICAL DATA - SAMPLING OF TANK WASTE AND WASTE TYPES

- IIa. Sampling of Tank 241-AW-104
- IIb. Sampling of 242-A Evaporator Streams

III. COMBINED ANALYTICAL/NON-ANALYTICAL DATA

- IIIa. Inventories Using Both Campaign and Analytical Information
- IIIb. Compendium of Existing Physical and Chemical Documented Data Sources

The bibliography is broken down into the appropriate sections of material with an annotation at the end of each reference describing the information source. Most information listed below is available in the Lockheed Martin Hanford Corporation Tank Characterization and Safety Resource Center.

I. NON-ANALYTICAL DATA

Ia. Models/Waste Type Inventories/Campaign Information

Jungfleisch, F. M., and B. C. Simpson, 1993, *Preliminary Estimation of the Waste Inventories in Hanford Tanks Through 1980*, WHC-SD-WM-TI-057 Rev. 0A, Westinghouse Hanford Company, Richland, Washington.

- A model based on process knowledge and radioactive decay estimations using ORIGEN for different compositions of process waste streams assembled for total, solution, and solids compositions per tank. Assumptions about waste/waste types and solubility parameters and constraints are also given.

Ib. Fill History/Waste Transfer Records

Agnew, S. F., R. A. Corbin, T. B. Duran, K. A. Jurgensen, T. P. Ortiz, and B. L. Young, 1997, *Waste Status and Transaction Record Summary (WSTRS) Rev. 4*, LA-UR-97-311, Rev. 0, Los Alamos National Laboratory, Los Alamos, New Mexico.

- Contains spreadsheets showing all available data on tank additions and transfers.

Koreski, G. M., 1997, *Double-Shell Tank Inventory and Material Balance Report for April, 1998*, (internal letter 7A140-98-024 to Distribution) Lockheed Martin Hanford Corp. for Fluor Daniel Hanford, Inc., Richland, Washington.

- Letter contains tank transfer data and tank inventory information for all double shell tanks.

Ic. Surveillance/Tank Configuration

Lipnicki, J., 1997, *Waste Tank Risers Available for Sampling*, HNF-SD-RE-TI-710, Rev. 4, Lockheed Martin Hanford Corp. for Fluor Daniel Hanford, Inc., Richland, Washington.

- Document identifies riser locations for each tank. An estimate of the risers available for sampling is also included.

Salazar, B. E., 1994, *Double-Shell Underground Waste Storage Tanks Riser Survey*, WHC-SD-RE-TI-093, Rev. 4, Westinghouse Hanford Company, Richland, Washington.

- Document shows tank riser locations in relation to tank aerial view as well as a description of riser and its contents.

Tran, T. T, 1993, *Thermocouple Status Single-Shell & Double-Shell Waste Tanks*, WHC-SD-WM-TI-553, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

- Document contains riser and thermocouple information for Hanford Site waste tanks.

Id. Sample Planning/Tank Prioritization

Benar, C. J., 1997, *Tank 241-AW-104 Push Mode Core Sampling and Analysis Plan,* WHC-SD-WM-TSAP-139, Rev. 0A, Lockheed Martin Hanford Corporation, Richland, Washington.

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Brown, T. M., J. W. Hunt, and L. J. Fergestrom, 1998, *Tank Characterization Technical Sampling Basis*, HNF-SD-WM-TA-164, Rev. 4, Lockheed Martin Hanford Corp. for Fluor Daniel Hanford, Inc., Richland, Washington.

- Document summarizes the technical basis for characterizing tank waste and assigns a priority number to each tank.

DOE-RL, 1996, *Recommendation 93-5 Implementation Plan,* DOE/RL-94-0001, Rev. 1, U.S. Department of Energy, Richland, Washington.

- Document describes of the organic solvents issue and other tank issues.

Ecology, EPA, and DOE, 1997, *Hanford Federal Facility Agreement and Consent Order,* as amended, Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Olympia, Washington.

- Document contains agreement between the U.S. Environmental Protection Agency, U.S. Department of Energy, and Washington State Department of Ecology that sets milestones for completing work on the Hanford Site tank farms.

EPA, 1990, *"Identification and Listing of Hazardous Wastes,"* 40 CFR 261, U.S. Environmental Protection Agency, Washington, D.C.

- Document identifies and lists hazardous waste, and defines procedures for determining if a waste should be classified as hazardous.

Grimes, G. W., 1977, *Hanford Long-Term Defense High-Level Waste Management Program Waste Sampling and Characterization Plan*, RHO-CD-137, Rockwell Hanford Operations, Richland, Washington.

- Document contains plan for characterizing waste, short- and long-term goals, tank priority, analysis needs, estimates of analyte concentrations per waste type, and a characterization flowsheet.

Halgren, D. L., 1991, *Double-Shell Tank Waste Analysis Plan,* WHC-SD-WM-EV-053, Rev. 1, Westinghouse Hanford Company, Richland, Washington.

- Document outlines the methods for sampling and analysis needed to meet specific data requirements.

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- Document contains vapor sampling and analysis procedure for 200 Area Tanks.

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- Document establishes a basis for Tank Waste Remediation System facilities and operations required for the storage management of high-level radioactive waste, current and future.

Public Law 101-510, 1990, *"Safety Measures for Waste Tanks at Hanford Nuclear Reservation,"* Section 3137 of *National Defense Authorization Act for Fiscal Year 1991.*

- Document creates the Safety Watch List for the Hanford Site tank farms.

Winkelman, W. D., M. R. Adams, T. M. Brown, J. W. Hunt, D. J. McCain, L. J. Fergestrom, 1997, *Fiscal Year 1997-1998 Waste Information Requirements Document*, HNF-SD-WM-PLN-126, Rev. 0A, Lockheed Martin Hanford Corp. for Fluor Daniel Hanford, Inc., Richland, Washington.

- Document contains Tri-Party Agreement (Ecology et al. 1996)and DNFSB requirement-driven TWRS Characterization Program information.

Ie. Data Quality Objectives (DQO) and Customers of Characterization Data

Bauer, R. E., and L. P. Jackson, 1997, *Data Quality Objective to Support Resolution of the Flammable Gas Safety Issue*, HNF-SD-WM-DQO-004, Rev. 3, Duke Engineering & Services Hanford, Inc. For Fluor Daniel Hanford, Inc., Richland, Washington.

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- Document contains requirements for addressing compatibility issues usually associated with waste transfers.

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II. ANALYTICAL DATA - SAMPLING OF TANK WASTE AND WASTE TYPES

IIa. Sampling of Tank 241-AW-104

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Mauss, B. M., 1986, *86-3 Evaporator Campaign: Laboratory Analysis Data,* (internal letter 65453-86-060, to R. T. Kimura, April 29), Rockwell International, Richland, Washington.

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Mauss, B. M., 1984, *Chemical Compositions of 102-AY, 101-AW, 105-AN, and 104-AW*, (internal letter 65453-84-348 to E. G. Gratny, November 9), Rockwell International, Richland, Washington.

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- Letter report contains September 1994 supernatant sample analysis results.

Steen, F. H., 1997, *Tank 241-AW-104, Cores 204 and 206 Analytical Results for the Final Report*, HNF-SD-WM-DP-264, Rev. 0, Waste Management of Hanford, Inc. for Fluor Daniel Hanford Inc., Richland, Washington.

- Document contains sample analysis results from June 1997 core sampling event.

IIb. Sampling 242 A-Evaporator Waste Streams

Gough, G. L., 1988, *242-A Evaporator/Crystallizer Fiscal Year 1987 Campaign Run 87-1 Post-Run Doc.*, SD-WM-PE-034, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

- Document contains historical sample analysis results as applicable to the 242-A Evaporator.

Jansky, M. T., 1984, *Feeds for 242A Evaporator Run 84-4,* (internal letter 65453-84-092, to N. L. Pontious, April 3), Rockwell International, Richland, Washington.

- Letter contains historical sample analysis results and boildown data of samples tested in support of 242-A Evaporator Run 84-4.

Jones, T. E., 1997, *Tank Characterization Report for Double-Shell Tank 241-AW-101*, WHC-SD-WM-ER-470, Rev. 0A, Lockheed Martin Hanford Corp., for Fluor Daniel Hanford Inc., Richland, Washington.

- Document contains information on 242-A Evaporator waste and PL2 waste.

Mauss, B. M., 1986, *242-A Evaporator Campaign 86-1: Laboratory Analysis,* (internal letter 65453-86-023, to R. T. Kimura, February 20), Rockwell International, Richland, Washington.

- Letter contains historical sample analysis results and X-ray analysis of solids from samples.

Mauss, B. M., 1986, *86-5 Evaporator Campaign: Laboratory Analysis of Samples,* (internal letter 65453-86-114 to J. C. Starr, September 18), Rockwell International, Richland, Washington.

- Letter contains historical sample analysis results of slurry and feed samples taken for 86-5 evaporator campaign.

Mauss, B. M., 1985, *242-A Evaporator Run 85-1: Laboratory Results and Chemical Analysis*, (internal letter 65453-85-010 to N. L. Pontious, January 16), Rockwell International, Richland, Washington.

- Letter contains historical sample analysis results of slurry and feed samples taken for 85-1 evaporator campaign.

Pontious, N. L., 1984, *242-A Evaporator/Crystallizer FY '84 Campaign Run 84-4 Post Run Document*, SD-WM-PE-017, Rev. 0, Rockwell Hanford Operations, Richland, Washington.

- Document contains historical sample analysis results.

Pontious, N. L., 1985, *242-A Evaporator/Crystallizer Fiscal Year 1985 Campaign Run 85-1 Post-Run Document*, SD-WM-PE-019, Rev. 0, Rockwell Hanford Operations, Richland, Washington.

- Document contains historical sample analysis results.

Starr, J. C., 1987, *242-A Evaporator/Crystallizer Fiscal Year 1986 Campaign Run 86-5 Post-Run Document*, SD-WM-PE-032, Rev. 0, Rockwell Hanford Operations, Richland, Washington.

- Document contains historical sample analysis results as applicable to the 242-A Evaporator.

III. COMBINED ANALYTICAL/NON-ANALYTICAL DATA

IIIa. Inventories from Campaign and Analytical Information

Agnew, S. F., J. Boyer, R. A. Corbin, T. B. Duran, J. R. Fitzpatrick, K. A. Jurgensen, T. P. Ortiz, and B. L. Young, 1997, *Hanford Tank Chemical and Radionuclide Inventories: HDW Model Rev. 4*, LA-UR-96-3860, Rev. 0, Los Alamos National Laboratory, Los Alamos, New Mexico.

- Document contains waste type summaries and primary chemical compound/analyte and radionuclide estimates for sludge, supernatant, and solids.

Brevick, C. H., J. L. Stroup, and J. W. Funk, 1997, *Historical Tank Content Estimate for the Southeast Quadrant of the Hanford 200 Areas*, WHC-SD-WM-ER-350, Rev. 1, Fluor Daniel Northwest, Inc., Richland, Washington.

- Document contains summary information from the supporting document as well as in-tank photo collages and the historical inventory estimates.

Schmittroth, F. A., 1995, *Inventories for Low-Level Tank Waste*, WHC-SD-WM-RPT-164, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

- Document contains a global inventory based on process knowledge and radioactive decay estimations using ORIGEN2. Pu and U waste contributions are taken at 1 percent of the amount used in processes. Also compares information on Tc-99 from both ORIGEN2 and analytical data.

IIIb. Compendium of Data from Other Physical and Chemical Sources

Brevick, C. H., J. L Stroup and J. W. Funk, 1997, *Supporting Document for the Southeast Quadrant Historical Tank Content Estimate Report for AW-Tank Farm (Volume I and II)*, HNF-SD-WM-ER-316, Rev. 1, Fluor Daniel Northwest, Inc., Richland, Washington.

- Document summarizes historical information such as waste history, temperature profiles, psychometric data, tank integrity, inventory estimates and tank level history.

Jones, T. E., R. T. Winward, and M. J. Kupfer, 1997, *Tank Characterization Report for Double-Shell Tank 241-AW-104,* WHC-SD-WM-ER-453, Rev. 0A, Westinghouse Hanford Company, Richland, Washington,

- Document contains the best-basis inventory for double-shell tank 241-AW-104.

Brevick, C. H., L. A. Gaddis, and E. D. Johnson, 1995, *Tank Waste Source Term Inventory Validation, Vol I & II.*, WHC-SD-WM-ER-400, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

- Document contains a quick reference to sampling information in spreadsheet or graphical form for 23 chemicals and 11 radionuclides for all the tanks.

De Lorenzo, D. S., A. T. DiCenso, D. B. Hiller, K. W. Johnson, J. H. Rutherford, D. J. Smith, and B. C. Simpson, 1994, *Tank Characterization Reference Guide,* WHC-SD-WM-TI-648, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

- Document summarizes issues surrounding characterization of nuclear wastes stored in Hanford Site waste tanks.

Hanlon, B. M., 1998, *Waste Tank Summary Report for Month Ending May 31, 1998*, WHC-EP-0182-122, Lockheed Martin Hanford Corp. for Fluor Daniel Hanford, Inc., Richland, Washington.

- Document contains a monthly summary of the following: fill volumes, Watch List tanks, occurrences, integrity information, equipment readings, equipment status, tank location, and other miscellaneous tank information.

Husa, E. I., 1993, *Hanford Site Waste Storage Tank Information Notebook,* WHC-EP-0625, Westinghouse Hanford Company, Richland, Washington.

- Document contains in-tank photographs and summaries on the tank description, leak detection system, and tank status.

Husa, E. I., 1995, *Hanford Waste Tank Preliminary Dryness Evaluation,* WHC-SD-WM-TI-703, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

- Document assesses relative dryness between tanks.

LMHC, 1998, Tank Characterization Database, July 1998, Internet at http://twins.pnl.gov:8001/TCD/main.html, Lockheed Martin Hanford Corp. for Fluor Daniel Hanford, Inc., Richland, Washington.

- Database contains analytical data for tank 241-AW-104 and all tanks.

Shelton, L. W., 1996, *Chemical and Radionuclide Inventory for Single- and Double-Shell Tanks*, (internal letter 74A20-96-30 to D. J. Washenfelder, February 28), Westinghouse Hanford Company, Richland, Washington.

- Letter report contains a tank inventory estimate based on analytical information.

Van Vleet, R. J., 1993, *Radionuclide and Chemical Inventories for the Double-Shell Tanks*, WHC-SD-WM-TI-543, Rev. 1, 1993, Westinghouse Hanford Company, Richland, Washington.

- Document contains selected sample analysis tables before 1993 for double shell tanks.

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